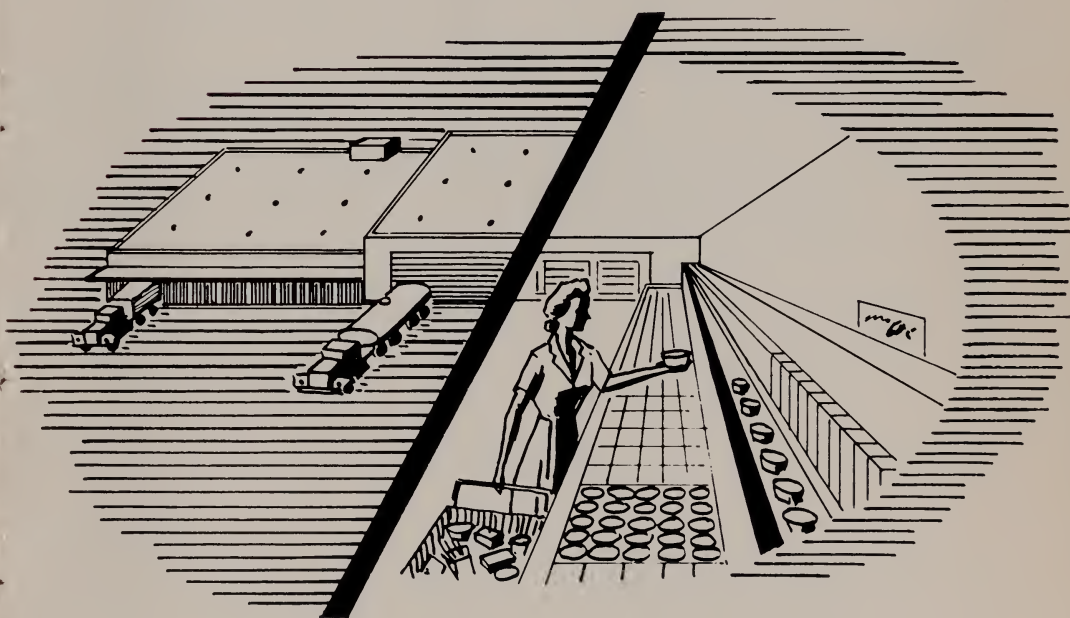




Structural Changes in the California Fluid Milk Industry

• • *their effects on competition
and market performance*



Daniel I. Padberg and D. A. Clarke, Jr.

This bulletin investigates the postwar changes in the structure of California's fluid milk industry, particularly changes in the number and size distribution of buyers and sellers. It explores the effects of these changes on the economic performance of the industry, especially on competition within the industry and market results.

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Background and Nature of the Study¹

Organization of firms

Three types of firms, or individual decision-making units, operate within the fluid milk industry—dairy farms, processing plants, and retail food stores. All three have undergone major structural changes over the years. Dairy farms, relatively atomistic in structure, are excluded from consideration in this analysis which focuses attention on the processing firms and the retail food stores.

According to the California Crop and Livestock Reporting Service, 540 fluid milk processing firms were active in California in 1960. A large proportion of processor sales, however, are concentrated within a few large firms. Some of these have developed multiplant processing and distribution systems, particularly in wholesale operations.

Approximately 40 per cent of the fluid milk distributed in California reaches the consumer through about 10,000 retail food stores. Sales are concentrated in the largest few firms, however, because of the development of supermarket chains.

Because of the importance of milk and dairy products in the human diet and because milk is readily susceptible to disease-producing bacteria, the dairy industry is subject to more governmental regulation than most other food industries. Public controls include laws prohibiting fraud and adulteration and regulations designed to improve the sanitary qualities of milk and its products. In addition, the dairy industry is the only agricultural industry whose prices (for milk for fluid consumption) are established by the government.

In California, the main governmental agencies regulating the fluid milk industry are the Bureau of Dairy Service and

the Bureau of Milk Stabilization, both part of the California Department of Agriculture. The Bureau of Dairy Service, together with municipal health authorities, establishes and maintains sanitary specifications and inspections for milk-producing and milk-processing units. The Bureau of Milk Stabilization establishes minimum prices for milk for fluid purposes at all levels of distribution, including producer, wholesale, and retail prices. The Bureau also enforces those sections of the Agricultural Code which prohibit the use of "unfair practices" by the firms operating in the fluid milk industry.² Unfair practices include various types of price and "nonprice" competitive devices, such as the use of secret rebates, unearned discounts, and the provision of services, equipment, or financial assistance at prices which are below costs.³

Development of the industry in California

Historically, the organizational framework of the fluid milk industry was very simple and all firms operated in rather small units. Because of the bulk and perishability of the product and the lack

² The Milk Stabilization Laws, as they are commonly known in California, appear in chapters 16 and 17 of the Agricultural Code of the State of California. Chapter 16 contains provisions designed to control and prohibit unfair trade practices; chapter 17 contains authorization to establish minimum producer prices, processor margins, and store margins.

³ For a discussion of the nature and operation of the California milk stabilization program, see J. M. TINLEY, *Public Regulation of Milk Marketing in California* (Berkeley: University of California Press, 1938), 213p. Also, D. A. CLARKE, JR., *Fluid Milk Price Control in California: A Report to the Joint Legislative Committee on Agriculture and Livestock Problems* (Sacramento: State Printing Office, 1955), 191p.

¹ Submitted for publication Oct. 10, 1963.

of modern transport facilities, production was located near consumption centers. The producer sold his output directly to final consumers, either delivered or on his premises. Milk was seldom pasteurized or packaged in the early days, and little, if any, processing was required. Around the turn of the century, however, new processing functions were created by the establishment of sanitary standards and the development of new techniques. Standard pasteurizing procedures, mechanical refrigeration, glass bottles, and sanitary standards for production were among the advances introduced. At about the same time, expansion of urban areas in the state made it feasible to separate the production and distribution segments of the industry. Specialization in both production and processing was greatly encouraged by these changes and by the potential scale economies in the performance of new processing functions which had entailed substantial investment in equipment. By 1920, fluid milk processing as a separate industry was generally established in the urban areas of California. Although the growing cities pushed milk producers farther away from consumption centers, the level of development in handling and transporting techniques determined the organization of production into fairly tight "milksheds" around each city. Thus, in the early 1920's the fluid milk processing industry in California was typically composed of single-plant firms which collected milk from nearby farms and sold it bottled and processed in a single town or urban area.

In the decade between 1925 and 1935, a fundamental change took place in the type, number, and size of firms. By 1935, seven multiplant firms had been established, the largest two having more than ten plants each. This resulted from large manufactured-dairy-product firms entering the fluid milk processing enterprise. By this time, fluid milk processing functions had been developed to such a degree

that considerable investment in specialized equipment was required. It is likely that the superior financial strength of the manufacturing firms, coupled with the opportunity to gain better utilization of their existing plant facilities, encouraged these multiplant companies to enter the fluid milk operations.

The fluid milk industry grew rapidly during World War II. Between 1940 and 1942, four counties—Alameda, Los Angeles, San Diego, and San Francisco—from which a great part of the Pacific operations was supplied, increased their annual output of processed milk by more than 34 million gallons, or 28 per cent.⁴ Although the dairy procession industry expanded throughout the state, these four counties gained in relative importance, moving from 68.8 per cent to 73.2 per cent of the state total. This expanded output resulted primarily from increased volume per plant, since plant numbers declined during the war.

Following the war, other significant changes affected the processing industry. Annual government purchases of fluid milk in California dropped from the 1945 level of 9.8 million gallons to 2.5 million gallons in 1947.⁵ Paper (fiber) containers, which had been introduced in Los Angeles and San Francisco as early as 1938, had come into general use during the war. Large plants in the four counties mentioned had not previously shipped their output over very great distances. Now such shipments were facilitated by the wide use of these lightweight paper containers and by the extensive postwar road construction program, which increased the miles of freeway in California by 145 per cent, from 588.8 at

⁴ California Department of Agriculture, *Statistical Report of California Milk Products and Lists of California Milk Products Plants, 1942* (Sacramento, 1942), p. 15.

⁵ California Crop and Livestock Reporting Service, *California Dairy Industry Statistics for 1954: Manufactured Dairy Products, Milk Production, Utilization, and Prices* (Sacramento, 1954), p. 35.

the close of the war to 1,440.3 by December, 1949.⁶

Mergers and sale or dissolution of some business entities in the postwar period resulted in a new consolidation of the fluid milk processing industry, and some existing firms that were operating high-capacity urban plants were motivated to penetrate new areas to increase their plant volume and operating efficiency. The incentive to increase plant size was especially stimulated by the adoption of paper containers. The greater capacity of equipment adapted to paper containers gave large wholesale processors a competitive advantage over small processors because this technique is associated with high cost for small-scale operations. Consequently, many local processors were acquired by larger firms and others were completely crowded out of the market. Thus the number of processors declined while the market share of larger firms increased.

Purpose of the study

The postwar consolidation movement could have two possible serious repercussions: First, the welfare of many individuals could be affected, since increased consolidation necessarily caused many firms to disappear. Second, greater concentration could bring about possible monopolization and associated economic exploitation, for as numbers of firms declined, some existing processors greatly increased their market shares. Is it not likely that such increased economic power of the large companies might affect the welfare of all interested parties—including final consumers, producers, and competing distributors?

In the light of these possibilities, it was determined that this study would appraise and evaluate the following questions:

(1) How and to what extent has the structure and institutional framework of the fluid milk processing industry

changed during the past decade? Answers to this question required an investigation of changes in the numbers and size distributions of both buyers and sellers of processed fluid milk in California and in the relationships between these buyers and sellers.

(2) What has been the effect of the observed structural changes upon competition within these industry segments during the postwar period? Answers to this question required an investigation of changes in the extent and degree of market power possessed by both buyers and sellers within the industry.

(3) Finally, what has been the consequent effect of such changes upon market performance, that is, market results? While answers to this question cannot be precise, investigations were made into various appropriate measures of market performance, including analyses of intermarket and interproduct price and product-service combinations.

Explanation of terms as used in this analysis⁷

To avoid ambiguity of meaning, this section explains several important concepts used in this report which are somewhat imprecise and commonly used with varying interpretation: market structure, market conduct, market performance, competition, and the relevant market. They are given more detailed treatment in later sections when specific application is made to the fluid industry. Those already familiar with these concepts may prefer to proceed directly to page 9.

Market structure

Structural characteristics include the number and size distribution of buyers

⁶ *California Highways and Public Works*, vol. XXIX, nos. 3/4, March–April, 1950, p. 57.

⁷ Based, with some modification, on the classification system in J. S. BAIN, *Industrial Organization* (New York: John Wiley & Sons, Inc., 1959), chap. II, pp. 19–43.

and sellers, entry conditions, and the extent of product differentiation. The term "industry structure" is used when these measures are applied to a group of buyers or to a group of sellers; the term "market structure" when the attributes of both buyers and sellers are considered together as a group.

Market conduct

"Market conduct" refers to the market practices and policies of both buyers and sellers. The specific price policies of individual firms provide examples of market conduct. Although the concept includes the practices of both sellers and buyers, it is often convenient to discuss the conduct of sellers or buyers separately.

Market performance

"Market performance" refers to the economic end results obtained from an industry, largely derived from its structure and conduct. These results are reflected in the amount and variety of goods and services produced per unit of resource inputs. Important dimensions of market performance are technical (cost) efficiency, profit rates, and the amount of selling and promotion cost; also important, but varying in different industries, are progressiveness in adopting new and more efficient technology, product development, and the degree of variety and choice offered to consumers.

Measurement of market performance would ideally constitute a comparison of observed results in a particular industry with some optimum. Each performance dimension would be weighted according to its importance. Such a ratio of observed results to optimum results would be useful for making comparisons with performance levels in similar industries in alternative areas and perhaps relating performance levels to conditions of market structure across many industries. Unfortunately, no optimum or "ideal" standard of market performance is avail-

able; most dimensions of market performance, particularly technical efficiency and product quality, are affected by the state of the arts and therefore change over time. Furthermore, no "standard" of progressiveness is available.

While it is presently impossible to compare observed results with such ideal standards, it may be possible to note the way these results are affected by changes that have occurred over time. If such cause and effect relationships can be observed, market performance may be "improvable" by making appropriate changes within the industry. It is from this perspective that the term market performance is used in this analysis.⁸

Competition

The meaning of competition is typically surrounded by considerable ambiguity. This concept has been used in less than parallel manner by economists, law makers, and business people. Further, the term competition takes on different connotations when used in connection with the structure of markets, the conduct of market participants, or the nature of economic results obtained in markets. Since competition can refer to different aspects of a market and has special meaning among the several groups interested in market activity, in its broad sense it is not sufficiently precise to be useful in empirical research. Therefore, for purposes of this study, it is essential to bring this broadly used concept into more specific focus.

Competition may be regarded as a pattern of incentives which determines the way various individual decision-making units operating in this economic system react to each other. The nature of these interrelationships and interdependencies shapes the pattern of performance

⁸ It is in this sense that the criteria indicated here are similar to the concept of "workable" competition as developed by J. M. CLARK, J. W. MARKHAM, S. SOSNICK, and others.

in specific industries. Our tradition of economic thought has seen competition in its "pure" form as a set of incentives under which firms struggle for survival by reducing the costs of operation. Individually, they can have no effect on the market (because of atomistic structure, homogeneous products, etc.). In such an idealistic economic system, market participants can in this sense affect their rivals only by lowering their costs.

Economic results—and so, market performance—are optimal in this textbook type of competition in that firms are motivated to use the most efficient production operations, profits equal normal return on investment, selling costs are not incurred, and product development is consistent with consumer wants.⁹ While this rather formal development probably dominates the concept of competition, our experience with antitrust policy concerning "restraint of trade" of various types has broadened the concept. A "lessening of competition" has typically been defined as the imposition of some restraint of trade. It is from this general background that purity of competition has come to imply a system of incentives in which rivalry of firms includes only the firm policy dimensions affecting costs. The core of this ideal concept is that no market participant has "market power," the ability to affect the demand facing rivals. Market power implies imperfection—or a lesser degree of competition. It therefore follows that there are gradations in competition ranging from pure form to monopoly. In actual markets the pattern of incentives is not restricted to internal (firm) policy and therefore market power is typically present in some degree.¹⁰

Market power of sellers may be defined as the ability of an individual

firm to affect the demand facing rival sellers. The concept may be extended to include interactions between buyers and sellers. In this sense, market power of sellers (buyers) becomes the ability to deny or restrict alternative sources of supply (market outlet) to buyers (sellers). The expansion of the use of this definition to express the interrelations between alternative market participants is not inconsistent because the ability of sellers, for example, to deny or restrict alternative sources of supply to buyers is the same thing as reducing the demand facing rival sellers. The ability to obtain preferential reception from buyers by differentiating firm output is an example of market power which has the effect of both restricting alternatives to buyers and reducing the demand facing rival sellers. In this study efforts will be made to determine the effect that changes in the firms comprising the fluid milk industry have had upon the pattern of incentives to which market participants respond—or the nature of competition.

The relevant market

To be meaningful, the term relevant market must be defined in two dimensions: product dimension and geographic dimension. The basic determinant for the product dimension is substitution. Related products are considered to be within the relevant market if they are substitutable. In any practical case, few classes of commodities are perfectly substitutable. Generally, when any product may be used interchangeably with the product under consideration, the two products are considered to be the same and so included within the relevant market. This interchangeability is measured conceptually by substitution or cross elasticities. As reliable substitution elasticities are difficult

⁹ Development of this proposition is presented in TIBOR SCITOVSKY, *Welfare and Competition: the Economics of a Fully Employed Economy* (Chicago: RICHARD D. IRWIN, Inc., 1951) 457p.

¹⁰ Professor J. K. GALBRAITH in *American Capitalism, the Concept of Countervailing Power* (Boston: Houghton Mifflin Company, 1952) 217p., has given considerable illumination to the economic power implications of our concept of competition.

to obtain empirically, other indicators may be used to establish substitutability.¹¹ The "dividing line" that separates products is in a sense arbitrary and may differ for different classes of products.

The geographic dimension of the relevant market must be defined in the context of the geographic area in which the major forces that affect the supply of or demand for a product are reasonably homogeneous. This implies the absence of institutional, geographic, or economic barriers to free flow and interchange within, though not between, the areas of competition so designated. An example from the dairy industry may serve to clarify this concept more fully. It can be argued that the relevant market for butter encompasses the nation in its entirety, since this is a homogeneous, undifferentiated product that can be and is shipped at low transfer cost per unit of value between widely separated geographic areas. Further, wholesale sellers of butter—manufacturers and brokers—

¹¹ A discussion of empirical evaluation of the product dimension of the relevant market may be found in E. T. GREYER, "Economic Analysis in Antitrust Enforcement," *The Antitrust Bulletin*, vol. I, no. 4, January–February, 1959, p. 59.

are well informed with respect to geographic price differences and act rationally on that knowledge in making decisions concerning the ultimate destination of shipments. For this reason, a firm that handles a relatively large proportion of the total butter sales within a given metropolitan area is powerless to influence price, to practice discrimination, or to act in any fashion other than that of a "price taker."

Conversely, either of two variants from this example would result in more limited areas of effective competition. One is the existence of institutional barriers to free access by certain sellers such as would result from health department licensing provisions which define a limited "eligible supply." The other is the existence of high transport costs that essentially isolate and insulate a given geographic area from the effects of either supply or demand conditions in remote regions. The concept of the relevant market in the space dimension, then, includes any geographic subdivision of the total supply of a product, the control of which—due to isolation or insulation from alternative supply—gives the seller a measure of market power.

Factors Affecting Structural Development

This section investigates the external environmental changes which would be expected to influence industry structure, but no attempt is made to explain these changes. For example, data concerning changes in processing and delivery techniques are presented not to show why they were adopted, but rather to investigate their impact.

Distributive channels

A distinction is made between whole-

sale and retail channels of fluid milk distribution based on the general differences in characteristics of buyers (customers of the processing firms) and in processing facilities required, as determined by type of container used. Generally, wholesale refers to sales to groceries, restaurants, and institutions; retail, to direct sales to households for final consumption.

According to this classification system, the wholesale channel includes sales on wholesale routes and sales to the federal

Table 1
SALES OF FLUID MILK BY TYPE OF TRADE, CALIFORNIA, 1950-1962

Year	Total sales	Wholesale*		Retail†	
		gallons	per cent	gallons	per cent
1950.....	330,739,647	172,646,096	52.2	158,093,551	47.8
1951.....	352,819,374	189,111,184	53.6	163,708,190	46.4
1952.....	375,563,056	205,091,285	54.6	170,471,771	45.4
1953.....	389,027,284	210,463,761	54.1	178,563,523	45.9
1954.....	398,068,816	209,867,218	52.7	188,201,598	47.3
1955.....	424,620,600	223,299,764	52.6	201,320,836	47.4
1956.....	458,345,993	246,262,182	53.7	212,083,811	46.3
1957.....	477,661,208	266,534,954	55.8	211,126,254	44.2
1958.....	485,274,351	274,576,168	56.6	210,698,183	43.4
1959.....	496,516,709	280,561,567	56.5	215,955,142	43.5
1960.....	499,799,389	282,973,367	56.6	216,826,022	43.4
1961.....	499,284,205	288,678,934	57.8	210,605,271	42.2
1962.....	474,100,813	266,369,804	56.2	207,731,009	43.8

* Includes wholesale sales of fluid milk; sales of fluid milk to federal government; and, in 1959-1962, sales of concentrated fluid milk (whole milk equivalent).

† Includes home-delivery sales, cash-and-carry sales, sales to peddlers, and sales unclassified by type of trade.

Sources:

1950-1956: California Crop and Livestock Reporting Service, *Dairy Information Bulletin* (Sacramento, monthly issues).

1957-1962: *Idem*, *California Dairy Industry Statistics for 1957: Manufactured Dairy Products, Milk Production, Utilization, and Prices* (Sacramento, 1957, and subsequent annual issues).

government. The retail channel includes sales on retail home-delivery routes, sales to peddlers (retail distributors who buy processed milk rather than operate a plant¹²), sales by cash-and-carry operators, and sales of a small group of producer-distributors who are not required to classify sales by type of trade. (See table 14, page 32.) As shown in table 1, during the years 1950-1962 wholesale channels took slightly more than half of total California milk sales. There was a slight trend from retail to wholesale during the 13-year period.

Production and consumption trends

Table 2 shows the difference between the annual production of Grade A milk fat and annual consumption of Class I milk fat (primarily fluid milk and fluid cream.)¹³ The years for which data are available, 1944 to 1962, may be divided into three periods. During 1944, 1945, and 1946, the excess of production over

consumption—6.3, 3.4, and 4.7 per cent, respectively—was in each year lower than the excess normally required to allow for “necessary” surplus, standby.¹⁴ During this three-year period the California Bureau of Dairy Service authorized milk produced on ranches with facilities not meeting Grade A standards

¹² The peddler category includes some fluid milk purchased from processors by a dealer and later resold at wholesale to food stores or restaurants. This very likely represents a small part of peddler sales and is not considered separately for lack of available data.

¹³ These data understate the actual surplus, particularly in more recent years, as explained in the following pages.

¹⁴ On the basis of variation of production and consumption within years and between years during the 1944-1961 period, it appears that 10 per cent annual excess is ample standby to provide an adequate milk supply during the months of lowest production. This figure, while arbitrary, closely corresponds to the “other than Class I” usage reported for 1947, the year which followed the revocation of the emergency permits.

Table 2
COMMERCIAL PRODUCTION AND USAGE OF GRADE A MILK FAT
CALIFORNIA, 1944-1962

Year	Commercial production	Class I usage	Other than Class I usage	
	thousand pounds			per cent of production
1944	110,729	103,731	6,998	6.3
1945	117,825	113,825	4,000	3.4
1946	128,580	122,569	6,011	4.7
1947	136,289	122,565	13,724	10.1
1948	135,274	123,173	12,101	8.9
1949	139,485	124,853	14,632	10.5
1950	142,842	128,640	14,202	9.9
1951	149,547	134,880	14,667	9.8
1952	153,077	141,869	11,208	7.3
1953	164,871	145,893	18,978	11.5
1954	171,621	148,494	23,127	13.5
1955	179,351	157,435	21,916	12.2
1956	191,244	168,108	23,136	12.1
1957	210,691	174,148	36,543	17.3
1958	215,679	175,739	39,940	18.5
1959	229,511	179,253	50,258	21.9
1960	230,133	180,422	49,711	21.6
1961	236,510	179,544	56,966	24.1
1962	240,104	181,913	58,191	24.2

Sources:

1944-1960: California Crop and Livestock Reporting Service, **California Dairy Industry Statistics for 1960: Manufactured Dairy Products, Milk Production, Utilization, and Prices** (Sacramento, 1960), p. 37.

1961-1962: *Idem*, **California Dairy Industry Statistics for 1962: Manufactured Dairy Products, Milk Production, Utilization, and Prices** (Sacramento, 1962), p. 34.

to be used as Class I milk if the bacteria count met Grade A standards.¹⁵ By August, 1946, however, the Bureau concluded that "within the next few months there would be sufficient regularly qualified Grade A producers to meet all demands for market milk."¹⁶ The war-emergency permits were revoked on December 31, 1946. A general balance be-

tween production and consumption of Grade A milk was maintained during the years 1947 through 1952. On the average, milk fat production during this period exceeded consumption by 9.4 per cent. Surplus Grade A production began to increase after 1952, and by 1957 was well in excess of standby requirements. In 1962, the amount of Grade A milk fat used for non-Class I uses had reached 24.3 per cent of total production. This particular estimate and probably the estimates in other recent years are believed to understate the actual surplus, since some milk that is otherwise eligible for Grade A use cannot find a market through a Grade A plant but is received instead at a manufacturing plant and is therefore reported as manufacturing rather than Grade A supply.¹⁷

¹⁵ "Emergency permits" for the use of such milk for fluid uses were authorized by Assembly Bill 934, which became effective in May, 1943.

¹⁶ California Bureau of Dairy Service, *Circular Letter No. 29 to Approved Milk Inspection Services*, by O. A. GHIGGOILE (Sacramento, August, 1946).

¹⁷ See California Crop and Livestock Reporting Service, *California Dairy Industry Statistics for 1962: Manufactured Dairy Products, Milk Production, Utilization, and Prices* (Sacramento, 1963), p. 13.

Changes in techniques of processing and distribution

Until 1938, most fluid milk was processed in the following manner: local processing plants received milk in cans; pasteurized it in vat-type equipment (a batch process); bottled it in glass containers; and distributed it to local accounts. The same equipment processed products for both wholesale and retail distribution.

After the adoption of a series of new techniques, fluid milk processing became specialized. Milk for all uses was received in bulk tanks and plant operations were converted to a continuous-flow process. Milk for wholesale distribution was packaged in single-service paper containers and delivered to accounts which were sometimes located throughout several metropolitan areas. Retail distribution continued to be essentially a local operation, but wholesale distribution tended toward centralized processing.

The equipment used in this specialized wholesale processing operation generally required less labor but raised fixed plant costs. For this reason, the new operation was feasible only when plant volume was high. Paper containers were generally adopted in the early 1940's. Table 3 shows the trend of sales of packaged fluid milk since that time.¹⁸

Changes in economies of scale

Paper containers found quick acceptance, particularly in groceries and restaur-

rants, because container weight was reduced and the need for deposits and returns on glass bottles eliminated.

The adoption of paper containers brought about further technological and, eventually, structural changes. No longer was milk for wholesale and retail customers processed identically. Wholesale operations, using paper containers, required new and separate filling equipment and additional facilities for supplying containers to the filler. The initial cost of this new, complicated processing equipment was relatively high compared with the cost of glass bottling equipment, and the single-trip paper container itself was considerably more expensive than the returnable glass bottle. The cost disadvantage of paper containers versus glass proved to be particularly severe for low-volume operations. A monthly volume of about 250,000 gallons is normally sufficient to gain essentially all apparent available scale economies for a glass operation, while such scale economies for the paper operation extend beyond 600,000 gallons per month. Consequently, the adoption of the paper container created a considerable advantage for large-scale operations. A tendency developed toward centralized processing which resulted in a further tendency towards a smaller number of large-sized processing plants.

Scale economies of some magnitude were also provided by the adoption of the high-temperature, short-time (HTST) pasteurizing techniques which made it possible to shift from a batch process to a continuous-flow operation. This not only eliminated some of the bottlenecks of the old procedure, but also favored the substitution of equipment for labor and thus provided substantial incentive for larger and larger volume to fluid milk processing plants. While small-volume operations can use HTST equipment, it is then usually operated well below capacity.

These changes in technology were likely to influence the structure of the

¹⁸ It has been suggested that the adoption of paper containers has acted as a catalyst in the adoption of other techniques. See HUGH L. COOK, *Paper Packaged Milk in Wisconsin: Its Part in Expanding Distribution Areas*, Wisconsin Agricultural Experiment Station Research Bul. 179 (Madison, 1953), p. 33. The extent to which this causal relationship was important in California is unknown. The adoption of bulk farm collection methods, however, appears to have occurred at about the same time as the adoption of paper containers. See U. S. Economic Research Service, *The Dairy Situation*, June, 1957, p. 20.

Table 3

PERCENT OF PACKAGED FLUID MILK SOLD IN PAPER CONTAINERS IN OCTOBER BY PLANTS LOCATED IN
SELECTED MARKETING AREAS IN CALIFORNIA, 1940-1962*

Year	Alameda	Santa Clara	San Francisco	Sacramento	Fresno	Los Angeles	San Bernardino	San Diego	Eight-county aggregate	All other counties	California
1940.....	31.8	0.9	20.5	18.1	—†	—	—	9.2	—	—	—
1941.....	31.6	20.9	23.3	24.2	0	—	—	14.1	—	—	—
1942.....	41.1	47.4	29.8	31.4	1.4	—	30.6	21.7	—	—	—
1943.....	43.5	53.7	38.7	31.6	0	—	41.9	24.6	—	—	—
1944.....	44.8	45.9	41.8	32.7	0	38.9	31.5	22.1	37.6	—	37.7‡
1945.....	43.9	45.7	41.3	28.7	0	39.8	33.4	33.3	38.8	—	38.9‡
1946.....	45.1	40.7	49.7	29.4	0	40.9	33.6	39.9	40.7	—	40.8‡
1947.....	45.0	51.3	56.4	42.9	36.2	44.4	41.8	40.7	45.2	—	45.3‡
1948.....	47.5	57.7	58.5	53.4	35.5	45.6	46.9	44.0	47.4	—	47.5‡
1949.....	—	—	—	—	—	—	—	—	—	—	—
1950.....	—	—	—	—	—	—	—	—	—	—	—
1951§.....	68.2	52.7	71.1	75.4	82.2	53.9	64.1	39.1	58.8	58.4	58.7
1952.....	65.0	56.1	78.8	73.9	84.6	55.2	65.7	40.0	60.3	62.2	60.6
1953.....	57.7	55.1	75.9	78.1	85.6	57.7	68.1	47.1	61.4	63.7	61.7
1954.....	53.8	50.2	75.3	76.4	85.2	55.2	64.0	48.1	59.0	63.0	59.7
1955.....	60.7	43.6	75.0	75.4	83.8	52.7	59.9	43.2	57.4	63.1	58.4
1956.....	63.2	44.6	70.8	76.4	81.5	54.9	61.8	46.1	59.0	60.6	59.2
1957.....	62.8	46.9	75.6	78.8	84.9	60.5	65.6	42.2	62.5	64.0	62.7
1958.....	63.1	48.0	76.2	80.0	84.8	64.1	67.0	46.8	64.9	64.5	64.9
1959.....	62.7	49.0	75.5	80.5	83.0	63.4	62.3	57.2	65.3	61.5	64.7
1960.....	63.0	50.2	77.7	81.0	80.1	60.9	64.2	52.2	63.5	62.2	63.4
1961.....	65.9	51.9	78.3	82.6	87.1	63.3	65.4	46.0	66.0	66.6	66.1
1962.....	68.6	55.0	78.5	84.3	84.1	65.8	60.0	56.2	68.2	67.7	68.2

* Computations are based upon the assumption that all third quarts are packaged in paper.

Where no distinction was made in the basic data between glass and paper, it was assumed that these sales were in glass.

† Dashes indicate data not available.

‡ Estimate based upon the relationship between the eight-county aggregate from 1951 to 1961 and the California aggregate for the same period. (Estimated percentages from the two aggregates was multiplied by the eight-county aggregate figures for the period 1944-1948.)

§ Revised data.

Sources:

1940-1948: California Department of Agriculture, **Average Daily Sales of Fluid Milk by Trade and Size of Container** (Sacramento, October issues of monthly mimeographed reports by marketing areas).

1951-1962: California Crop and Livestock Reporting Service, **Sales of Fluid Milk by Type of Trade and by Size and Type of Container, California, October, 1951** (Sacramento, 1951, and subsequent annual issues).

processing firms of the fluid milk industry. They tend to centralize processing and, because of the cost disadvantages of a diversified processing line and the advantage of high wholesale volume, encourage specialization.

Changes in transportation cost

The shift from glass bottles to paper containers also had a marked effect upon transportation cost, mostly because weight was reduced and handling costs of return bottles eliminated.

Other factors, external to the processing firm, affecting the technical efficiency of delivery operations include:

- The increase in average volume per

¹⁹ For a discussion of the effect of volume per stop on delivery operations, see CLARKE, *Milk Delivery Costs and Volume Pricing Procedures in California*, California Agricultural Experiment Station Bul. 757 (Berkeley, 1956), 77p.

²⁰ See *California Highways and Public Works*, vol. XXIX, nos. 3/4, March–April, 1950, p. 57, and California Department of Public Works, Division of Highways, *Thirteenth Annual Report* (Sacramento, 1960), p. 61.

delivery as a consequence of the development of large supermarkets.¹⁹

- The longer shelf life or refrigerator life of fluid milk because of improved sanitation techniques. This reduces distribution costs by requiring less frequent delivery and, in some cases, every-other-day processing.

- The increase of California highways from 1,440 miles in 1950 to 4,894 miles in 1959.²⁰ It is likely that the increasing availability of highway transportation has significantly heightened the trend toward large, centralized processing plants and intermarket distribution from a single plant.

Structure of Market Participants

The relevant market

Any analysis of the relevant market for an industry and its products must be considered in two dimensions. First, the product dimension must take into account all alternative products which are sufficiently related in demand characteristics (substitutes) as to be regarded as similar products. Second, the geographic dimension must take into account all of the geographic area in which the forces affecting supply and demand are sufficiently homogeneous as to preclude any effective division of the area into separate parts.

Product dimension

The product dimension of the fluid milk market is less difficult to define than it is for most other products. The rather special demand characteristics for fluid milk make it a product for which few close substitutes are available. However,

there are other factors that are sufficiently influential as to require certain deviations within the fluid milk classification. Prominent among these factors are the wholesale and retail channels of distribution.

During the past decade, approximately 60 per cent of the fluid milk marketed in California has been processed in paper containers. Their advantages for wholesale operations have already been discussed. For retail operations, including home-delivery and cash-and-carry operations, glass bottles have some advantages over paper containers. Their cost is lower, particularly for small plants; and they seem to stand up better under conditions of retail home delivery. Also, savings in weight reduction per route load are not as important for retail as for wholesale deliveries—especially to larger-volume retail outlets.²¹ For these reasons

²¹ See CLARKE, footnote 19.

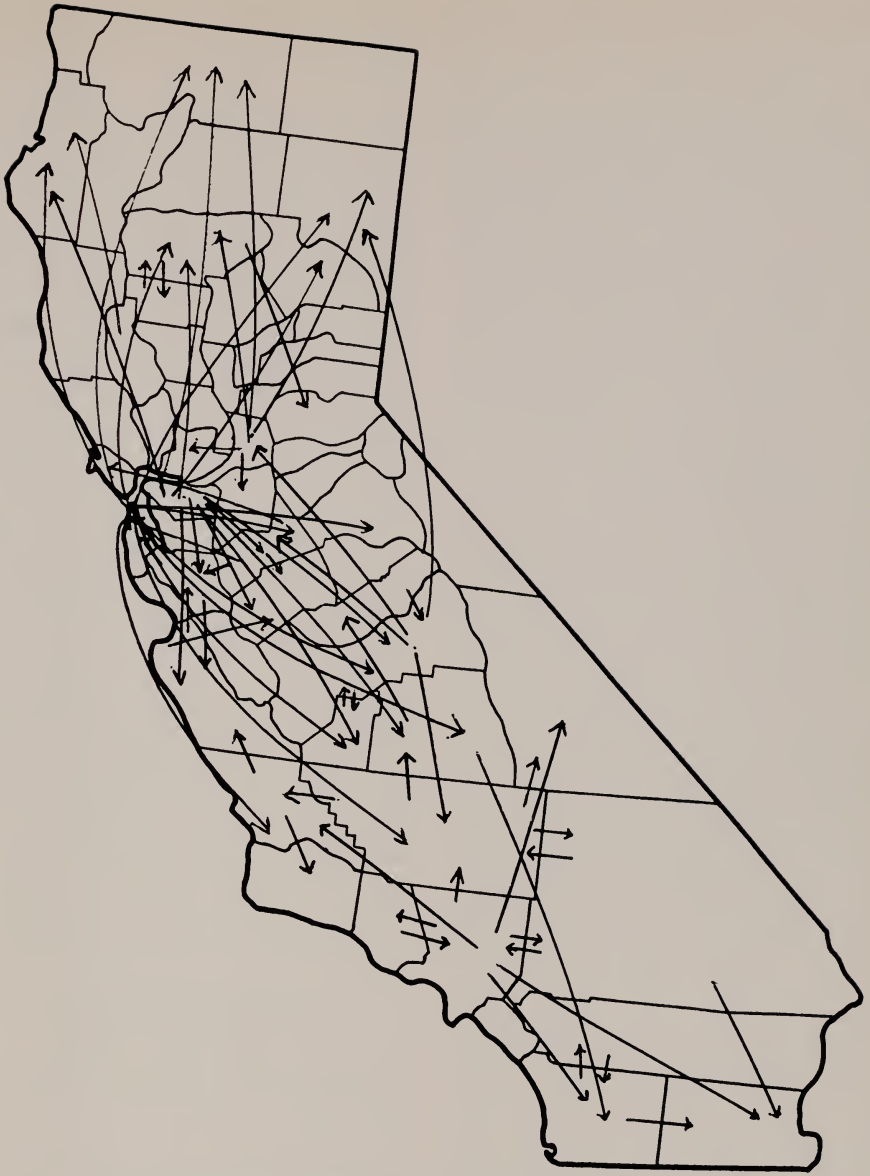


Fig. 1. Processed wholesale fluid milk trade flows, California 1960.

glass containers are used in retail operations, and paper containers are typically used in wholesale operations. Throughout the past 10 years, retail business has used more than 90 per cent glass, and wholesale business more than 96 per cent paper containers. A one-week survey of shipments of fluid milk to 257 retail stores in the Alameda-Contra Costa marketing

area made in 1960 showed that not a single store received any fluid milk in glass containers.²²

Although processors who package in

²² BARRY C. FIELD, "Customer Purchases of Fluid Milk in Grocery Stores and Dairy Drive-Ins with Special Reference to the Alameda-Contra Costa Marketing Area" (Berkeley: California Agricultural Experiment Station, 1961), p. 13.

paper typically have the option of glass, the reverse is not usually true. For reasons already mentioned, a processor who packages only in glass is excluded from the wholesale business. Therefore, while some wholesale processors may be engaged in retail operations, the wholesale and retail channels of distribution will nevertheless be treated separately. A further argument for this classification is that milk in paper containers available at the store, and milk in glass bottles delivered to the home, constitute different products because they combine a different product-service mix.

Geographic dimension

The current patterns of wholesale trade of fluid milk (figure 1) show a jumble of interrelated trade flows. Processing of wholesale fluid milk is concentrated largely in the San Francisco, Alameda, Sacramento, and Los Angeles counties and in the counties of the San Joaquin Valley—a relatively compact area of the state. The trade patterns shown indicate that processed milk is transported freely. No part of the geographic area can be separated from alternative wholesale milk processing centers. The relevant market for wholesale processing firms would therefore probably embrace the entire state.

Does it go beyond state boundaries? Very few out-of-state processors are suppliers for California wholesale accounts, mostly near the Oregon and Nevada borders. Municipal and state health regulations are largely responsible for this, for they require California inspection of producing and processing facilities for all fluid milk sold within the state. Topographical barriers and relatively low pro-

duction density in adjacent areas also limit trade from out-of-state processors. For these reasons, the relevant market for California wholesale processors as defined in this bulletin, includes only the processing firms within the state.²³

For retail fluid milk processors the higher cost of transporting milk in glass, the return trip required for empty bottles, and the small size of the typical retail account and route volumes, generally preclude handling over great distances. Retail processors located in a particular city would probably not be potential suppliers directly to housewives in a removed metropolitan area. In an analysis of retail sales by processors in 1962, it was found that only 54 out of 579 plants, or about 9 per cent, distributed milk beyond the boundaries of the marketing areas in which they were located. In an analysis of the location of sales on retail routes during the last decade, it was found that less than 4 per cent of the total volume was sold in state-designated marketing areas outside that of the processing plant. Therefore, it seems reasonable to conclude that for the most part the relevant market for the retail firm encompasses only the supply in the local metropolitan area where its processing plant is located.

Recent changes in the structure of buyers

Changes in the characteristics of buyers or sellers may result in changes in the competitive behavior and performance of an industry. Since the purpose of this study is to describe pertinent changes and their resultant influence upon competition and performance, it is important to consider changes in the relationships among fluid-milk buyers and fluid-milk sellers.

²³ Demand interrelationships between fluid milk and manufactured dairy products may be ignored due to the low substitutability of most products. On the other hand, supply interrelationships exist due to the low substitutability in the utilization of the common raw product. That is, a processor might decide to vary his utilization pattern, thus influencing the supply side of the market. However, within the constraints of the classified price system in California, the demand for milk for alternative uses are effectively separated. This has the further effect of limiting the impact of technical substitutability on the supply side and, for this reason, these relationships may also be ignored.

Once again, the retail and wholesale buyer-seller relationships will be treated separately.

Retail buyers

Retail buyers—those who purchase milk through home delivery or at cash-and-carry processing outlets—are typically households. As such, they may be described as “atomistic” in structure: each unit—buying or selling—is not large enough to have any appreciable influence on the market. Each unit is therefore considered a “price taker.” Households possess no market power since they can not affect the demands facing sellers or alternative buyers. In the California fluid milk industry, there has been no evidence of significant structural change in this segment over the past few years.

Wholesale buyers

The relative importance of wholesale buyers—retail food stores, restaurants, schools, and institutions—is given in table 4. The estimated percentages show that the retail food store is the principal outlet. Sales to schools, while not a large part of total wholesale sales, tend to be in terms of large accounts and so are of considerable importance to a particular seller. Such sales differ from those of other wholesale buyers since they are usually made on a specific term contract granted on a bid basis. The changing

structure of school systems is not being considered here. Little is known about the market structure of the other wholesale buyers—restaurants and institutions. It is assumed their structure resembles that of retail buyers and that they have undergone little structural change in recent years.

The retail food store industry has changed drastically in organization and structure over the past few decades. Two predominant aspects of this change have been the transition to chain-type operations and the increased size of individual units (the supermarket movement) both of which have resulted in increased buyer concentration.²⁴

The extent of these changes in the retail food industry is reflected in measures of concentration. Nationally, the concentration ratio of the largest 20 firms shows an increase from 29.3 in 1940 to 35.6 in 1958, while that of the largest four declined from 23.0 to 22.4.²⁵ It appears, therefore, that the increased concentration has not resulted from growth of the very largest firms but rather from growth of the relatively smaller firms. A similar pattern of development is apparent in the retail food industry of California, as indicated in tables 5 and 6.²⁶ While about one-third of the firms disappeared in the 10-year period 1948–1958, sales of retail food stores, which include both food and nonfood items, almost doubled during that time. The number of establishments

²⁴ A considerable amount of descriptive and analytical work has been done concerning this development. See, for example:

WILLARD F. MUELLER and LEON GAROIAN, *Changes in Market Structure of Grocery Retailing* (Madison: University of Wisconsin, 1961), 215p.

U. S. FEDERAL TRADE COMMISSION, *An Economic Inquiry Into Food Marketing. Part I: Concentration and Integration in Retailing*, 1960, 338p.

WILLIAM E. FOLZ and ALDEN C. MANCHESTER, *Chain Store Merchandising and Procurement Practices: The Changing Retail Market for Fresh Fruits and Vegetables*, U. S. Department of Agriculture Marketing Research Report No. 417, 1960, 24p.

D. B. DELOACH, *Changes in Food Retailing*, Washington Agricultural Experiment Station Bul. 619 (Pullman, 1960), 43p.

WILLARD F. WILLIAMS and EDWARD UVACEK, *Pricing and Competition on Beef in Los Angeles*, U. S. Department of Agriculture Marketing Research Report No. 413. 1960, 114p.

²⁵ MUELLER and GAROIAN, footnote 24, p. 4.

²⁶ STEPHEN J. HIEMSTRA and D. B. DELOACH, *Growth Patterns in the Retail Grocery Business*, California Agricultural Experiment Station Bul. 786 (Berkeley, 1962), 74p.

Table 4
ESTIMATED PERCENTAGES OF WHOLESALE FLUID MILK SALES, BY TYPE OF BUYER
CALIFORNIA, 1957-1961

Buyer	1957	1958	1959	1960	1961	1957-1961 average
Food stores*	77.1	78.8	78.6	78.6	78.3	78.3
Schools†	8.6	9.1	8.9	7.8	8.2	8.5
Restaurants and institutions						
Bulk‡	4.0	4.2	4.3	4.6	4.6	4.3
Others§	10.3	7.9	8.2	9.0	8.9	8.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Estimate based on the proportion of wholesale sales packaged in paper quart and half-gallon containers.

† Estimate based on the proportion of wholesale sales packaged in third-quart containers. (Third quarts are not a legal container for other types of sales.)

‡ Unpackaged milk usually delivered in 5-gallon cans.

§ Includes primarily pint and half-pint containers typically used for "on premises" consumption in restaurants.

Source: California Crop and Livestock Reporting Service, *Sales of Fluid Milk by Type of Trade and by Size and Type of Container, California, October, 1957* (Sacramento, 1957, and subsequent annual issues).

operated by chains increased by 26.4 per cent, while the number of chain store firms increased by 76.2 per cent. These figures suggest the same rapid growth of lesser-sized chain firms as that observed nationally.

Concentration ratios are used to measure the share of the total market controlled by particular groups of firms, while concentration curves show the share of the total market controlled by individual firms. Table 7 shows changes in concentration ratios for the largest four and the largest ten California firms, as well as for all chains combined, for the years 1950, 1954, and 1958. The concentration curves shown in figure 2 represent the relationships for the same three years of the ten largest firms arrayed by size, largest first, and their cumulative market shares. The shifts in level and shape of these curves indicate that among the largest ten firms, the largest three or four have not grown as rapidly as the others.

The concentration curves in figure 3 show changes in the concentration of total industry sales of all retail food firms in California. These curves show the share of the total sales handled by chain

store organizations, indicated by the steep portion of the curve, in relation to the sales by independent (nonchain) stores, indicated by the less steeply sloped portion of the curve. During the period between 1950 and 1958, the share of total food store sales controlled by chains increased by 56.9 per cent. During the same period, the number of independent stores decreased rapidly, but their overall size distribution remained essentially unchanged. This conclusion may be inferred from the generally similar slopes of the flatter part of the curve at all three time periods, since the slope of this curve represents market share per firm.

As shown in table 5, average annual sales of the individual grocery store increased 177 per cent, from approximately \$132,000 in 1948 to about \$366,000 in 1958. Even after deflation by the United States Retail Food Price Index, this represents an increase of 116 per cent. Some of the stores included in these data are not fluid milk market participants, namely those with an integrated fluid milk supply (retailer-owned processing facilities). Essentially all of these are chain stores. The share of total food store sales made by these stores has been esti-

Table 5

ESTIMATED NUMBER OF RETAIL GROCERY STORE ESTABLISHMENTS BY TYPE OF OWNERSHIP,
NUMBER OF RETAIL GROCERY STORE FIRMS, AND TOTAL RETAIL GROCERY STORE SALES
CALIFORNIA, 1948-1958

Year	Estimated number of grocery store establishments	Chain store outlets			One-store firms	Total number of firms	Grocery store sales	Sales per grocery store*
		Total number outlets	Number of firms	Outlets per firm				
	1	2	3	4	5	6	7	8
							million dollars	dollars
1948..	16,824	1,813	202	9.0	15,011	15,216	2,227	132,370
1949..	16,739	1,776	210	8.5	14,963	15,176	2,301	137,463
1950..	16,670	1,849†	232†	8.0	14,821†	15,053†	2,557	153,389
1951..	16,325	1,930	253	7.6	14,395	14,651	2,934	179,724
1952..	15,700	1,831	248	7.4	13,869	14,120	3,133	199,554
1953..	14,988	1,890	272	6.9	13,098	13,373	3,184	212,437
1954..	14,481	1,982	311	6.4	12,499	12,810	3,292	227,332
1955..	13,943	2,169	371	5.8	11,724	12,098	3,370	241,698
1956..	13,362	2,197	370	5.9	11,165	11,538	3,549	265,604
1957..	12,696	2,219	346	6.4	10,477	10,826	4,112	323,882
1958..	12,090	2,291	356	6.4	9,802	10,158	4,430	366,419

* Column 7 divided by column 1.

† Data for 1950 not available in original source; estimated by interpolation of 1949 and 1951 data.

Sources:

Cols. 1-6: Stephen J. Hiemstra and D. B. DeLoach, **Growth Patterns in the Retail Grocery Business**, California Agricultural Experiment Station Bul. 786 (Berkeley, 1962), Appendix Table 6, p. 71. (Note that column 3 plus column 5 does not equal column 6 in all cases.)

Col. 7: 1948, 1949, 1954, 1957, and 1958: *ibid.*, Table 3, p. 6. Other years: data obtained directly from the above authors.

Table 6

GROCERY CHAIN FIRMS AND STORES, CALIFORNIA, 1948-1958

Year	Number of stores per firm						Total	
	2-3		4-9		10 and over			
	firms	stores	firms	stores	firms	stores	firms	stores
1948.....	113	280	67	355	22	1,178	202	1,813
1949.....	124	301	64	336	22	1,139	210	1,776
1950*.....	140	335	68	350	24	1,164	232	1,849
1951.....	155	370	72	367	26	1,193	253	1,930
1952.....	164	382	63	346	21	1,103	248	1,831
1953.....	181	420	70	384	21	1,086	272	1,890
1954.....	219	506	68	367	24	1,109	311	1,982
1955.....	272	638	70	372	29	1,159	371	2,169
1956.....	271	621	68	353	31	1,223	370	2,197
1957.....	246	555	66	347	34	1,317	346	2,219
1958.....	255	568	68	358	33	1,365	356	2,291

* Estimated by interpolation of 1949 and 1951 data.

Source: Stephen J. Hiemstra and D. B. DeLoach, **Growth Patterns in the Retail Grocery Business**, California Agricultural Experiment Station Bul. 786 (Berkeley, 1962), Appendix Table 6, p. 71.

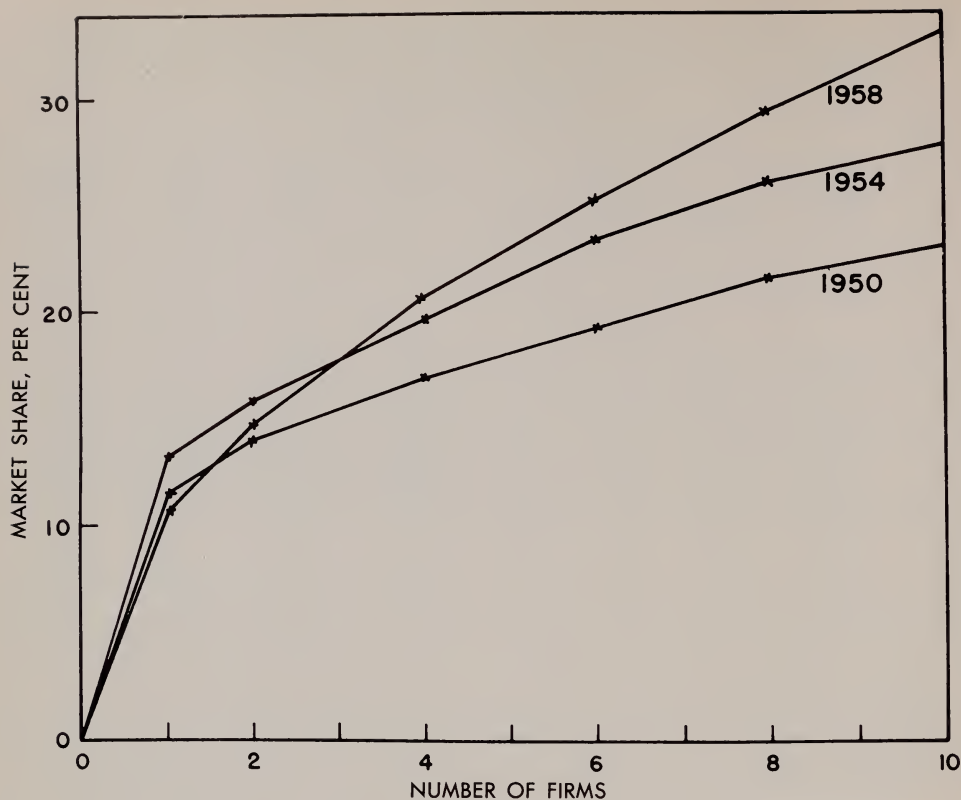


Fig. 2. Concentration curves of California retail food store industry, largest ten firms, 1950, 1954, and 1958.

Table 7
CONCENTRATION RATIOS FOR RETAIL GROCERY
STORES LARGEST FOUR, LARGEST TEN, AND ALL
CHAIN STORE FIRMS, CALIFORNIA,
1950, 1954, AND 1958

	1950	1954	1958
Largest four.....	16.9	19.6	20.6
Largest ten.....	22.7	27.8	32.9
All chains*.....	39.0	55.3	61.2

* Estimated by procedure outlined in Appendix A. There were 232 firms in 1950, 311 in 1954, and 356 in 1958. Sources: Table 5 and the following:

Moody's Industrial Manual ("Manual of Investments," Part III; New York: Moody's Investors Service, annual issues).

Walker's Manual of Pacific Coast Securities (San Francisco: Walker's Manual, Inc., annual issues).

This Week Magazine, **The Big Challenge in Food Marketing: 8th Biennial Grocery Study** (New York, 1959), pp. 66-70.

U. S. Federal Trade Commission, **An Economic Inquiry Into Food Marketing. Part I: Concentration and Integration in Retailing**, 1960, 338p.

ated at 13.5 per cent in 1950, 18.6 per cent in 1954, and 21.2 per cent in 1958.²⁷

When the share of integrated chain stores is subtracted from the share of total food store sales of all chains, it is found that nonintegrated chain stores (market participants) handled 25.5 per cent of all food store sales in 1950, increasing to 36.7 per cent in 1954 and

²⁷ These estimates are based upon the share of total wholesale milk which is processed by retailer-owned integrated supplies (table 12), the share of total wholesale milk composed of retail food stores (table 2), and the share of the total food store industry controlled by the one food chain store firm that is processor owned (1.0 per cent in 1950, 1.9 per cent in 1954, and 2.7 per cent in 1958). It is assumed that the share of total food store sales of an individual store is equal to the share of total food store sales of fluid milk represented.

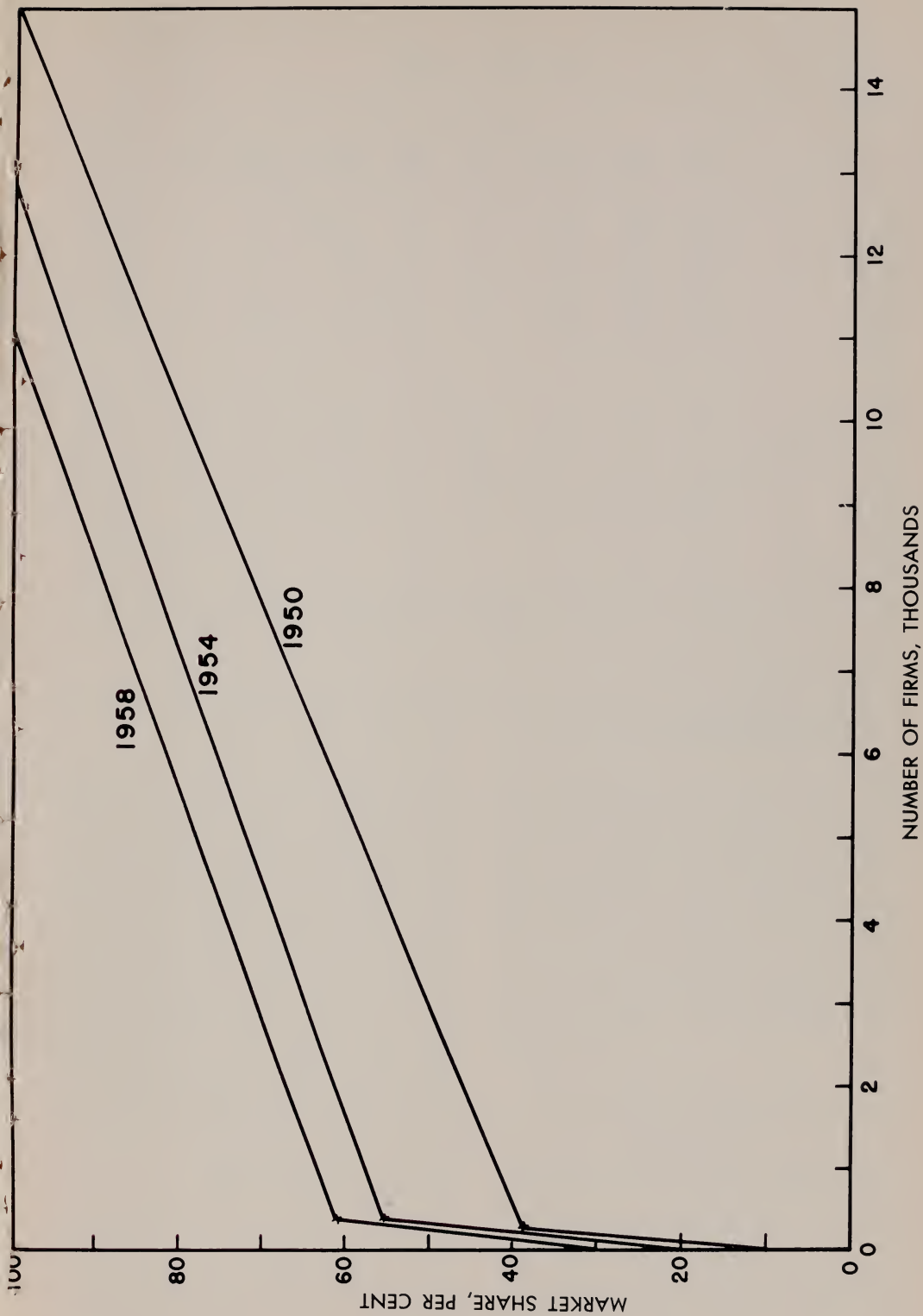


Fig. 3. Concentration curves, retail food store industry, California, 1950, 1954, and 1958.

Table 8

NUMBER OF PLANTS CLASSIFIED ACCORDING TO AVERAGE DAILY SALES OF FLUID MILK,
CALIFORNIA, 1943-1960

Year	Average daily sales of gallons of fluid milk								
	Under 50	50 to 150	150 to 250	250 to 500	500 to 1,000	1,000 to 3,000	3,000 to 5,000	5,000 and over	Total
1943.....	231	349	145	123	58	65	14	31	1,016
1944.....	190	320	138	111	76	65	18	32	950
1945.....	159	248	141	124	86	73	21	33	885
1946.....	148	253	119	115	73	77	24	30	839
1947.....	140	222	110	99	80	81	22	33	787
1948.....	140	205	101	95	84	89	20	32	766
1949.....	—*	—	—	—	—	—	—	—	—
1950.....	—	—	—	—	—	—	—	—	—
1951.....	69	100	57	82	68	88	18	49	531
1952.....	42	95	55	80	56	83	23	49	483
1953.....	36	94	59	73	66	82	27	52	489
1954.....	40	70	51	82	66	77	27	56	469
1955.....	35	64	54	89	74	74	26	61	477
1956.....	27	64	54	92	87	61	28	60	473
1957.....	24	61	51	87	84	67	28	59	461
1958.....	19	60	55	107	98	68	23	63	493
1959.....	19	66	69	116	101	65	23	66	525
1960.....	23	66	77	128	87	67	24	68	540

* Dashes indicate data not available.

Sources:

1943-1957: California Crop and Livestock Reporting Service, **California Dairy Industry Statistics for 1943: Manufactured Dairy Products, Milk Production, Utilization, and Prices** (Sacramento, 1943, and subsequent annual issues).
1958-1960: From special compilations.

40.0 per cent in 1958. Considering the "market" as that part of total food store sales which is not integrated with respect to fluid milk supply, the market share of chain-organized units increased from 29.5 per cent in 1950 to 45.1 per cent in 1954 and to 50.8 per cent in 1958. Clearly, conventional fluid milk processors are now facing a more highly concentrated group of buyers than in earlier years.

Recent changes in the structure of sellers

Fluid milk sellers may be defined in terms of their buyers: processing firms selling to wholesale buyers are classified as wholesale sellers, and those selling to retail buyers as retail sellers. Some processing firms may handle both classes of sales. Since 1950 significant changes

have occurred in the number and size distribution of all sellers, accompanied by a trend toward greater specialization. Other important changes include the increase in processor-retailer integration, the development and growth of "cash-and-carry" outlets by processing firms which sell directly to the consumer on their own premises, and the decline in importance of product differentiation. These structural changes are important because they explain changes in the competitive relationships among sellers and between buyers and sellers.

Turnover among sellers

The technological advances of the early 1940's had an influence on the structure of the group of sellers (processing firms) comprising the wholesale and the retail segments of the fluid milk industry. Al-

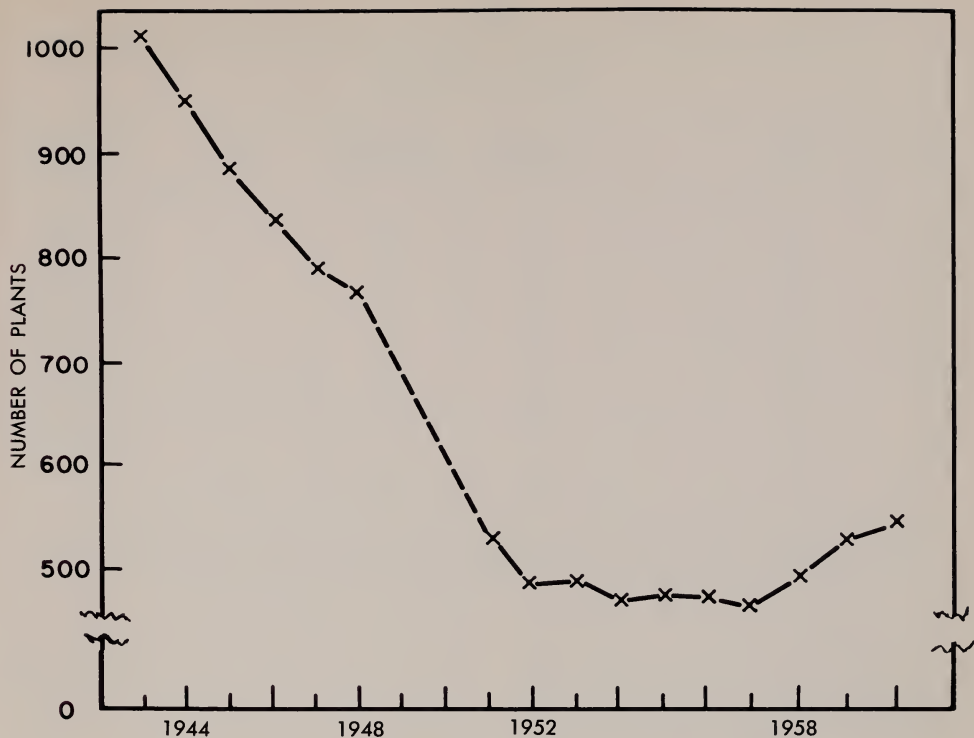


Fig. 4. Number of fluid milk processing plants, California, 1943-1960.

though wholesale and retail fluid milk operations constituted two separate segments of the market during the 1950's, this distinction was not so clear before the introduction of paper containers and the subsequent trend toward specialization and centralization of wholesale milk processing. The adjustment made by the aggregate of firms to changes in technology, in buyer concentration, and in production-consumption balances is shown in table 8. These data indicate that during the period 1943-60 the number of small plants decreased while the number of larger-volume plants (3,000 gallons daily and over) increased. The total number of plants decreased sharply between 1943 and 1952, continued to decline gradually for a few years, and in recent years has been rising—mostly because of the increasing number of processing plants which carry on a cash-and-carry business (figure 4).

Trends toward specialization are not reflected in these data but are indicated by the characteristics of firms which have entered and left the industry. The estimated gross and net changes in firm numbers for the years 1950-1958 are shown in table 9. Samples of the populations of 381 entrants (firms that entered the industry) and 493 exants (firms that left the industry) were investigated in order to estimate the general characteristics of each population. (See Appendix B for procedures.)

The size distribution of the firms in the fluid milk processing industry indicates the existence of many small business units. When many firms go out of existence, a large number of entrant firms is required to replace them. This type of turnover among firms does not in itself suggest a structural change. However, if the exants are replaced by units of a different kind, this turnover might alter

Table 9
ESTIMATED NUMBER OF ENTRANT AND EXANT FLUID MILK PROCESSING FIRMS
CALIFORNIA, 1950-1958

Year	Entry of firms January 1 to December 31	Exit of firms January 1 to December 31	Net change for year	Estimated number of processing firms, December 31*
1950.....	51	80	— 29	528
1951.....	29	69	— 40	488
1952.....	28	68	— 40	448
1953.....	41	51	— 10	438
1954.....	47	43	4	442
1955.....	48	50	— 2	440
1956.....	53	60	— 7	433
1957.....	33	31	2	435
1958.....	51	41	10	445
Total.....	381	493	—112	

* The differences in number of firms between this and table 8 are caused by the existence of multiplant operations.
Source: Data obtained from the California Crop and Livestock Reporting Service, the California Bureau of Milk Stabilization, and the California Bureau of Dairy Services on number of plants licensed and going out of business each year.

the structural development of the industry. From 1950 to 1958 several differences have been noted between the characteristics of entrants and exants. These characteristics are summarized in table 10.

From these data, it appears that exants have generally been replaced by smaller and less diversified firms. While 38 per cent of the exants had participated in both wholesale and retail markets, only 21.2 per cent of the entrants did so. Although both entrants and exants were typically retail, a greater proportion of entrants specialized in cash-and-carry operations. Of the 381 processing firms entering the fluid milk business between 1950 and 1958, 55 per cent produced all of their raw product supply and 63 per cent were cash-and-carry operations.

While these data do not tell the entire story, they suggest the following general structural adjustments. Firms handling from 1,500 to 24,000 gallons per month and serving both local wholesale and retail accounts, have been replaced in many instances by local retail firms, primarily of the cash-and-carry type. In the course of this adjustment, the total number of

processing plants in the state decreased sharply until 1958, but since then trended upward (table 8).

Changes in concentration of wholesale firms

As stated, specialization has tended to shift the emphasis of large firms toward wholesale operations and that of small firms toward retail operations. This influence, along with other technological and economic changes, has affected firm growth patterns and thus the level of concentration in the processing sector of the fluid milk industry. This section considers several alternative devices for measuring the degree of changing concentration in the wholesale market.

By treating the relative growth of firms as a random process, it is possible to use Markov processes for evaluating changes in seller concentration.²⁸ The purpose of this analytical technique is to investigate

²⁸ For a discussion of Markov processes and their adaptation to the analysis of structural change in this industry, see Daniel I. Padberg, "The Use of Markov Processes in Measuring Changes in Market Structure," *Journal of Farm Economics*, vol. XLIV, no. 1, February, 1962, pp. 189-199.

Table 10

COMPARISON OF CHARACTERISTICS OF ENTRANT AND EXANT FLUID MILK PROCESSING FIRMS,
CALIFORNIA, 1950-1958

Characteristic	Per cent of exants	Per cent of entrants
Size (monthly gallonage)		
Under 1,500	10.7	17.5
1,501-6,500	13.1	32.5
6,501-10,500	32.1	20.0
10,501-24,000	25.0	12.5
24,001 and over	19.1	17.5
Produced all of raw product handled	35.7	55.0
Had both retail and wholesale accounts	38.0	21.2
Predominantly retail (cash-and-carry plus home delivery equaled more than 75 per cent of sales)	72.6	86.3
Predominantly cash-and-carry (cash-and-carry over 50 per cent of sales)	21.4	63.8

Source: Compiled especially for this study from information provided by the California Bureau of Milk Stabilization.

the nature of the aggregate of forces affecting changes in size distribution and to represent graphically the tendencies of resulting firm growth. By observing the movement of firms between specified size categories over specified time periods, an equilibrium size distribution of firms can be generated. This equilibrium distribution is that which would be expected to result if the initially observed activity continued through infinite time periods.

The data used for this analysis were the wholesale sales volume for each wholesale milk processing firm for the months of January, 1950, 1955, and 1960. These data were obtained directly from the California Bureau of Milk Stabilization. Changes observed in the size distribution of firms are shown by the unbroken lines in figure 5 for each of these years. During the period between 1950 and 1955 considerable consolidation took place as the total number of firms in the wholesale industry dropped from 241 to 176. The number of larger firms (those controlling 50 per cent of

the market) dropped from 6 to 5, while the number of firms controlling 80 per cent dropped from 25 to 17, and those controlling 95 per cent dropped from 90 to 56. If consolidation were to continue indefinitely at this intensity, the equilibrium industry adjustment would place .03 firms in control of 50 per cent of the market, .23 firms in control of 80 per cent, and 6.45 firms in control of 95 per cent of the market.²⁰ The 1950-1955 equilibrium configuration of firms is shown by the broken line in figure 5.

Between 1955 and 1960, the total number of firms in the wholesale industry continued to decline—from 176 to 169. The number of firms controlling 50 per cent of the market remained 5, while those controlling 80 per cent dropped from 17 to 15, and those controlling 95 per cent dropped from 56 to 47. If consolidation were to continue indefinitely at this intensity, the equilibrium industry would have 2.25 firms controlling 50 per cent of the market, 7.65 firms controlling 80 per cent of the market, and 30.53

²⁰ This structural equilibrium is the type of industry size distribution which would result if the observed adjustment pattern were to continue through infinite time. Since the intensity of adjustment is related to many changing dimensions of the economic environment, a shift in intensity is likely to occur before the structural equilibrium is reached. For this reason, this analytical device is more useful as a reflection of intensity of adjustment than for purposes of forecasting future structure.

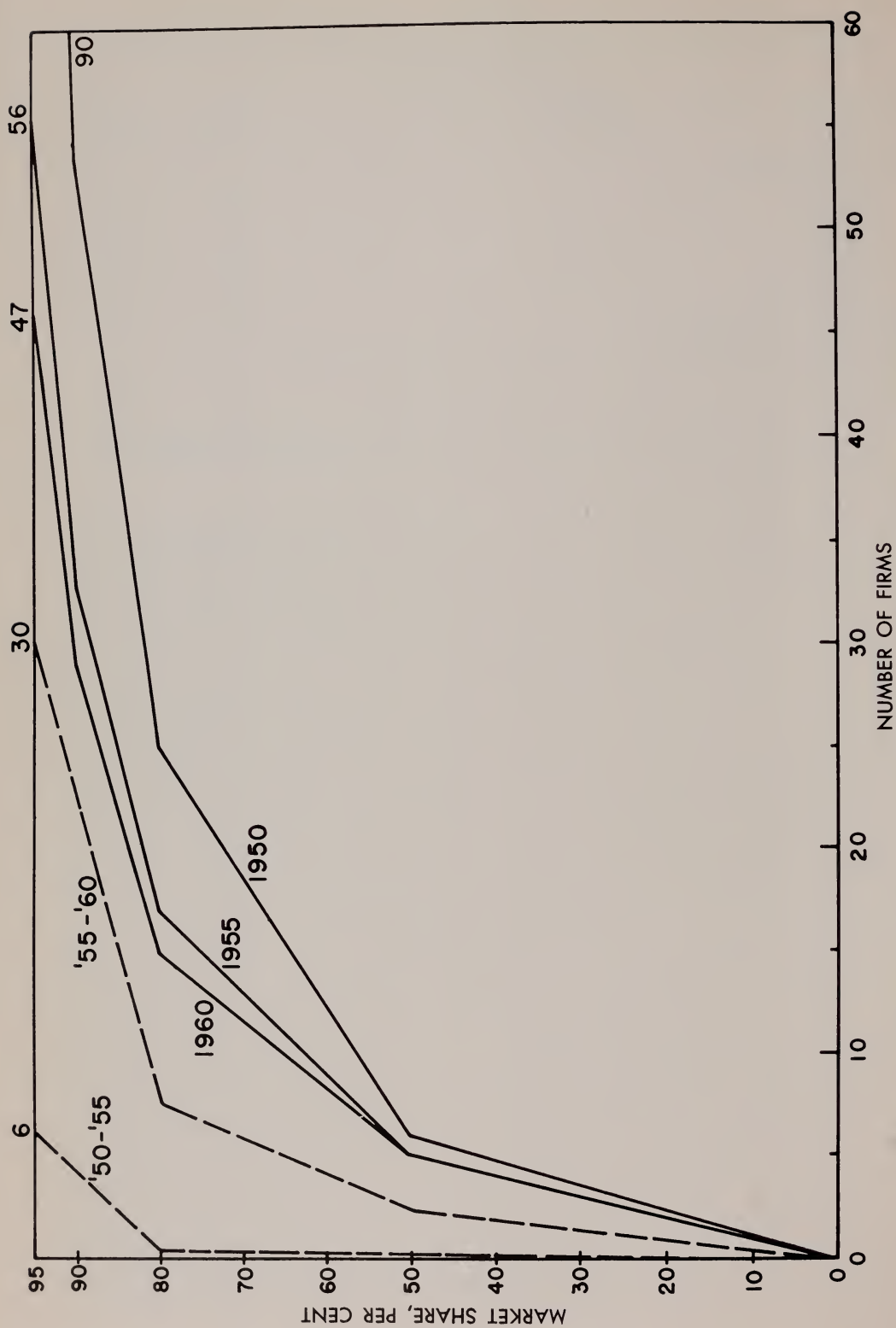


Fig. 5. Observed and generated size distributions of sellers in the California wholesale fluid milk market, 1950, 1955, and 1960.

firms controlling 95 per cent of the market. The 1955–1960 equilibrium configuration of firms is also shown by broken lines in figure 5.

This analysis shows that development of the size distribution of firms during the 1950–1955 period tended toward very high concentration. The equilibrium size distribution based on that period gives the largest firm more than 80 per cent of the market, while 95 per cent of the industry output is produced by only six firms. Activity during the 1955–1960 period also reflected a tendency toward consolidation, but to a lesser degree. Here, the equilibrium shows that the number of firms producing 95 per cent of industry output is reduced from the current (1960) 47 to 30 firms.

When this type of analysis is appropriate, it has an advantage over some other measures in that it takes into account developments in the whole size distribution instead of merely comparing one point on it at two different points in time. In evaluating the usefulness of this measure, it is helpful to compare it with some other measures that have been used for the same purpose in order to compare and contrast similarities and differences in results.³⁰ The measure of firm size distributions most commonly used is the concentration ratio. This expresses the *share* of the industry output, or some other size dimension such as assets, controlled by a given *number* of firms. When an analysis of concentration of economic power is the objective, this measure may be useful. The concentration ratios for the largest, 4, 8, and 20 firms for 1950, 1955, and 1960 are shown in table 11.

³⁰ Measures of firm configurations with respect to size distribution and the concentration of economic power have been discussed at considerable length. See:

GIDEON ROSENBLUTH, "Measures of Concentration," *Business Concentration and Price Policy: A Conference of the Universities-National Bureau Committee for Economic Research* ("National Bureau of Economic Research: Special Conference Series," No. 5; Princeton: Princeton University Press, 1955), pp. 57–99.

M. A. ADELMAN, "The Measurement of Industrial Concentration," *Readings in Industrial Organization and Public Policy: Selected by a Committee of the American Economic Association* ("Series of Republished Articles on Economics," vol. VIII; Homewood, Illinois: Richard D. Irwin, Inc., 1958), pp. 3–45.

These measures also indicate considerable consolidation in the 1950–1955 period, for the concentration ratios of the largest four and largest eight firms have increased greatly. The 1955–1960 period shows greater stability, the concentration ratio of the largest four firms having decreased slightly from 45.1 to 44.9, while that of the largest eight increased from 67.0 to 68.7.

The Orris Herfindahl concentration measure is designed to represent the degree of concentration throughout the industry size-distribution. This measure consists of the sum of the squared market shares of all market participants, all measured as percentages of total industry size. If all firms are of the same size, the index is equal to the reciprocal of the number of firms. When only one firm constitutes the industry, the value of this index becomes unity. The Herfindahl index for California wholesale fluid milk processors is also shown in table 11.

On the basis of these measures of structural development during the period 1950–1960 in the California wholesale fluid milk industry, the following observations may be noted. In the 1950–1955 period, by every measure, concentration increased. In the 1955–1960 period, concentration seemed to be generally increasing. A slight decrease in concentration is observed in the "largest four" grouping—a category widely used; but concentration increased in the other groups and by other measures. Comparisons of the concentration ratios of the two time periods indicates that concentration of industry output among the largest few firms increased faster in the

Table 11

MEASURES OF WHOLESALE SELLER CONCENTRATION, 1950, 1955, AND 1960, CALIFORNIA

	1950	1955	1960
Concentration ratio, largest 4 firms*.....	37.5	45.1	44.9
Concentration ratio, largest 8.....	59.3	67.0	68.7
Concentration ratio, largest 20.....	77.1	83.2	85.0
Herfindahl index†.....	.051912	.068798	.071120

* Concentration ratio = the sum of the shares of wholesale sales volumes controlled by the given number of firms.

† Herfindahl index = sum of squares of firm sizes, all measured as percentages of the total industry size.

Source: Compiled especially for this study from information provided by the California Bureau of Milk Stabilization.

early period. The Herfindahl index also indicates a stronger tendency toward increased concentration in the early period.

Another device used to measure relative firm size in an industry is the Lorenz Curve shown in figure 6. This presentation of data measures the degree of equality—or inequality. In cases of a constant total number of firms it also measures concentration. In the present illustration, total firms decreased 29.9 per cent from 1950 to 1960, and inasmuch as the number of firms producing 50 per cent of industry output remained almost constant, this measure shows less inequality in that part of the curve over time and more inequality in other parts of the curve over time. Because of the change in total firm numbers during this time period, the Lorenz Curves do not adequately measure changes in concentration within the industry.

A further measure pertinent to this analysis concerns not what has happened to the large and “dominant” firms but rather to the group of larger intermediate-size firms who might “compete” more directly with the large firms in the market. For this purpose, records were obtained of firms with plants producing in excess of 3,000 gallons of milk daily, but excluding those operated by multi-plant national or regional firms. In 1950, the output of these plants amounted to 28.4 per cent of the total reported sales of fluid milk, including both wholesale

and retail sales, in California. The percentage held by these “major independents” had increased to 32.4 per cent by 1952 and had risen to 43.2 per cent by 1957. By 1960 it had grown to 46.1 per cent.³¹

The evidence that the number of wholesale fluid milk sellers in California has decreased and that a larger share of the total market is controlled by the largest few firms would suggest, all other things being equal, that competition among these sellers has been lessened. This conclusion is based on the belief that seller concentration in a *market* affects competition.

As discussed earlier, the relevant market for fluid milk in California or that part of supply over which some control must be obtained before sellers can effectively influence the demands facing rivals and so possess market power, includes the entire state. However, for purposes of establishing minimum prices, the California Bureau of Milk Stabilization breaks down the state of California into various marketing areas. Twenty-six of these remained generally unchanged from January, 1950, to January, 1959, but several were combined during 1959. Useful information for 1960 is available for only 18 markets. The numbers of processors serving these marketing areas

³¹ These figures are not directly comparable to those presented in table 11 which related only to market sales of wholesale milk.

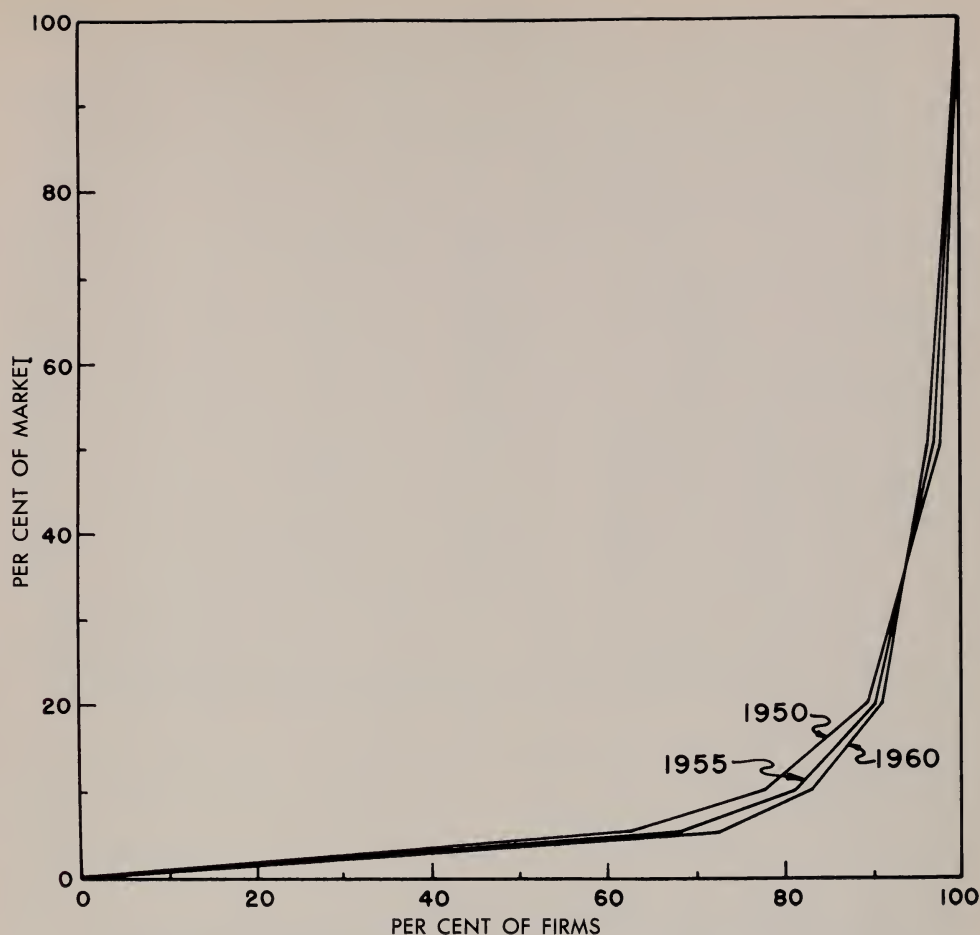


Fig. 6. Lorenz curves of sellers in the California wholesale fluid milk market, 1950, 1954, and 1960.

are shown in table 12. In this tabulation, a seller was counted even though his shipment to a particular marketing area was quite small. The concept considered here is the total number of participating suppliers.³²

These data show that although the number of sellers in California has decreased in total, those serving individual marketing areas have actually increased in some instances. Increases have occurred in 16 out of 26 cases and decreases in 7 cases, while only 3 areas have remained unchanged. In considering the averages of the first and last two years of the period, the number of sellers increased in 17 marketing areas, de-

creased in 8, and remained constant in 1.³³

³² It can, of course, further be argued that a seller may be a potential supplier in a market even though he makes *no* current sales. This would be true so long as there were no restrictions—either institutional or economic—to entry to a given geographic area. For the present purpose, however, the more restrictive definition of a supplier will suffice.

³³ Some of these marketing areas have changed from rural to urban use during this period—Orange County, for example. In this case the observed increase of wholesale suppliers from 5 to 17 reflects the change in urban development in addition to changes in competitive relationships. Across the several areas considered, however, these effects are most likely of minor importance.

Table 12
NUMBER OF WHOLESALE SELLERS, CALIFORNIA SELECTED AREAS, SELECTED YEARS

Marketing area*	1950	1952	1954	1956	1957	1958	1959	1960
Alameda-Contra Costa	17	16	15	18	20	21	19	22
Monterey-Santa Cruz	10	8	9	9	9	7	8	7
Marin	9	7	7	8	12	10	10	10
Napa-Sonoma	24	13	15	16	18	17	19	—†
Solano	8	8	6	8	7	9	8	8
Mendocino-Lake	11	5	6	6	8	4	4	—
Los Angeles	42	38	40	45	43	36	40	—
Orange	5	9	7	11	15	15	17	—
San Bernardino-Riverside	24	22	26	25	27	27	33	31
San Diego	10	11	12	14	16	13	15	15
Imperial	4	6	5	6	6	7	5	5
Ventura	8	8	7	6	10	7	8	—
Santa Barbara	5	6	5	5	6	6	6	—
San Louis Obispo	7	7	6	9	8	6	6	6
Fresno	9	10	12	16	16	15	17	16
Kings	1	2	7	9	9	8	8	8
Tulare	9	9	11	12	16	16	18	18
Kern	12	12	11	11	14	13	15	14
Madera-Merced	7	8	8	11	12	12	13	12
Stanislaus	10	9	9	10	10	10	10	10
Sacramento	18	14	15	18	13	11	14	—
Sutter-Yuba	3	3	3	6	7	8	9	—
Shasta-Tehama	3	3	3	4	6	7	7	7
Del Norte-Humboldt	9	7	6	5	7	6	7	6
Siskiyou	4	2	5	4	5	5	6	6
Inyo-Mono	5	6	7	8	7	8	7	7

* All marketing areas having changes in boundaries during 1950-1959 are excluded.

† Dashes indicate data not comparable with previous years due to changes in marketing area boundaries.

Source: Compiled especially for this study from information provided by the California Bureau of Milk Stabilization.

Changes in concentration of retail firms

An investigation analogous to that described above for the wholesale market is not possible for the retail market. While wholesale market participants are typically large specialized firms with well-defined characteristics for which rather complete data are available, retail distribution by processing firms is done through two major and some minor subchannels, with typically small firms for which available data are incomplete.

Since 1957, these subchannels have been classified as home delivery, cash-and-carry, peddler, and nonreporting.

Home delivery is self-explanatory—sales by processors directly to consumers' homes. Cash-and-carry represents sales to consumers on the premises of the processing firm. Before 1957, these sales, were included in the category "peddlers and platform" and were indistinguishable from the peddler group—distributors who do not themselves process any milk. The nonreporting category includes processing firms who produce all of their raw product and are not required by law to file monthly reports. Sales volumes for this group are estimated from an unclassified source.

Retail fluid milk sales volumes, by type of seller, are shown in table 13 for

Table 13
RETAIL FLUID MILK DISTRIBUTION, BY TYPE OF SELLER
CALIFORNIA, 1950-1962

Year	Total	Home delivery	Peddler	Cash-and-carry	Non-reporting
thousand gallons					
1950.....	158,178	112,836	—*	—	—
1951.....	163,541	112,615	—	—	—
1952.....	170,472	111,277	46,380		12,815
1953.....	178,711	114,429	50,635		13,647
1954.....	188,202	119,530	55,244		13,428
1955.....	201,321	127,859	62,069		11,393
1956.....	212,084	132,812	67,356		11,916
1957.....	211,376	130,091	42,717	25,552	13,016
1958.....	210,698	124,178	42,363	30,337	13,820
1959.....	215,955	126,664	43,687	36,715	8,889
1960.....	216,826	125,780	43,676	37,033	10,337
1961.....	210,605	119,647	45,385	45,573	0
1962.....	207,731	115,734	47,284	44,713	0

* Dashes indicate data not available.

Sources:

1950-1956: California Crop and Livestock Reporting Service, **Dairy Information Bulletin** (Sacramento, monthly issues).
1957-1962: **Idem**, **California Dairy Industry Statistics for 1957: Manufactured Dairy Products, Milk Production, Utilization, and Prices** (Sacramento, 1957, and subsequent annual issues).

the period 1950-1962. The major sub-channel, home delivery, decreased from 71.3 per cent of total retail sales in 1950, to 56.0 per cent in 1962. This decline in relative importance of home delivery sales by processing firms has been brought about by the rapid increase in cash-and-carry sales since 1957.

Since the relevant market for *home-delivered fluid milk* is more restricted geographically than that for wholesale operations, data about seller concentration must relate to a more local environment. The marketing areas established by the California Bureau of Milk Stabilization are suitable for this purpose.³⁴ However, changes in the boundaries of some of these marketing areas limit their use for measuring concentration changes over time. Therefore, only the

³⁴ Some of these established marketing areas probably correspond better with the concept of relevant market than others. This difference, however, is not sufficiently large to affect this analysis.

San Diego, Kern County, Fresno, and Del Norte-Humboldt marketing areas have been chosen to represent retail markets because their boundaries have not been shifted between 1950 and 1960, and the markets are self-contained, that is, supplied essentially by local processors. It has been assumed that buyers within these areas have no potential suppliers from other sources, since this is generally true for retail home-delivery.

Changes in retail concentration in these four areas between 1950 and 1960 are shown in table 14. In general, the market share of the largest firms was large but firm growth and changes in seller concentration varied both within and between the four areas. Two of these showed a consistent trend over the total 10-year period: Kern County toward greater concentration, and Fresno toward lesser concentration. Del Norte-Humboldt tended toward higher concentration in the first five-year period (1950-1955), while in the latter period (1955-1960)

Table 14
CHANGES IN CONCENTRATION IN THE RETAIL HOME-DELIVERY MARKET, 1950, 1955, AND 1960

Market area	1950				1955				1960			
	Number of firms	Per cent of market share		Number of firms	Per cent of market share		Number of firms	Per cent of market share		Number of firms	Per cent of market share	
		Largest two	Largest four		Largest two	Largest four		Largest two	Largest four		Largest two	Largest four
Del Norte-Humboldt.....	6	64.4	92.3	3	95.4	100.0	4	79.0	100.0	4	79.0	100.0
Kern.....	6	69.6	87.5	7	79.2	93.3	7	84.4	94.3	7	84.4	94.3
Fresno.....	6	61.8	87.3	10	47.5	79.7	9	42.2	79.8	9	42.2	79.8
San Diego.....	9	59.2	90.4	7	57.5	97.4	9	62.7	88.8	9	62.7	88.8

Source: Compiled especially for this study from information provided by the California Bureau of Milk Stabilization.

seller concentration declined. San Diego, during the earlier period, showed decreased concentration of the largest two firms but increased concentration of the largest four, while the situation was reversed in the latter period. The number of participants in 1950 was smaller than in 1960 in two cases, larger in one case, and unchanged in one case. No general trend seems apparent from these observed changes. It is clear that cash-and-carry operations have become a more important part of total retail sales. Aside from this, however, no systematic adjustments within the retail processing industry were noticeable. Retail home-delivery declined slightly, in number of processors, and became a smaller part of total retail. The growth pattern of individual firms suggests the relatively free opportunity for new firms to enter the market, as 381 firms entered the industry between 1950 and 1958 (see table 10).

California *cash-and-carry operations* are of two types: in one, production, processing, and sales all occur on the same premises and are carried on by the same firm. In the other, only the processing and sales facilities are integrated.

Cash-and-carry operations developed in southern California where both processing and resale to final consumers took place on the dairy farm or ranch. The exact date of its beginning is not known but it happened some time before the passage of the Desmond Act in 1937. Separate price schedules for ranch sales, in two marketing areas, were included in the first state-administered price schedules issued early in 1938; by 1940, resale price schedules included ranch differentials for eight marketing areas. In these eight early schedules, the pricing orders specified f.o.b. ranch price differentials of 2.2 cents per quart, on the average, under retail store prices. This differential was based on the elimination of farm assembly and delivery services since pro-

Table 15
NUMBER OF RETAIL SUPPLIERS
CALIFORNIA, SELECTED AREAS, SELECTED YEARS

Marketing area*	Home delivery						Cash-and-carry			
	1950	1952	1954	1956	1958	1960	1957	1958	1959	1960
Alameda-Contra Costa.....	16	14	13	13	15	17	3	6	15	22
Monterey-Santa Cruz.....	8	4	5	4	4	4	0	1	1	1
Marin.....	7	5	4	4	4	4	0	1	0	0
Napa-Sonoma.....	22	11	12	11	11	—†	1	2	4	—
Solano.....	6	7	4	3	3	3	0	0	0	1
Mendocino-Lake.....	5	2	3	2	4	—	0	0	0	—
Los Angeles.....	65	41	38	44	39	—	80	86	92	—
Orange.....	8	9	9	9	10	—	6	10	17	—
San Bernardino-Riverside.....	28	25	25	23	22	22	26	26	32	29
San Diego.....	9	7	7	10	9	9	14	13	13	12
Imperial.....	3	3	2	1	1	2	1	1	1	1
Ventura.....	7	6	5	4	4	—	2	2	2	—
Santa Barbara.....	3	3	2	2	3	—	0	1	1	—
San Luis Obispo.....	5	3	3	3	4	4	3	2	2	3
Fresno.....	6	7	7	10	10	9	1	2	3	3
Kings.....	1	1	3	4	4	3	1	1	1	1
Tulare.....	6	5	4	5	6	10	4	4	5	5
Kern.....	6	6	6	5	6	7	2	2	2	2
Madera-Merced.....	5	5	4	4	7	7	0	0	0	0
Stanislaus.....	8	7	8	7	9	8	3	5	4	4
Sacramento.....	16	11	14	15	10	—	7	6	8	—
Sutter-Yuba.....	1	0	0	1	4	—	1	2	2	—
Shasta-Tehama.....	2	2	1	2	3	4	1	0	3	0
Del Norte-Humboldt.....	6	7	4	3	4	4	0	1	2	0
Siskiyou.....	3	1	2	2	2	2	1	1	1	1
Inyo-Mono.....	5	3	4	4	3	3	2	2	2	1

* All marketing areas having changed boundaries during 1950-1959 are excluded.

† Dashes indicate data not comparable with previous years due to changes in boundaries in marketing areas that occurred in 1960.
Source: Compiled especially for this study from information supplied by the California Bureau of Milk Stabilization.

duction, processing, and sale all occurred at a single location.

Following this schedule of differentials came another system of differentials for f.o.b. plant sales which were applied to cash-and-carry operations of the second type described. These particular plant differentials were typically 1 cent per quart under retail store prices and were based on the elimination of wholesale delivery services. By 1947, 11 marketing areas had pricing orders which specified resale price differentials for this type of operation.

Although the cash-and-carry subchannel accounted for a fairly high number of firms in the early 1950's, only a small part of total sales was represented. Between 1957 and 1960, the number of cash-and-carry outlets increased in almost all markets (table 15), and their share of all fluid milk sales increased by 40 per cent.³⁵ These outlets have an advantage because the cash-and-carry dif-

³⁵ These data understate the number of cash-and-carry operations because "nonreporting" producer-distributors are not included in these statistics.

ferential permits them to undersell competition in the form of home-delivery or retail store sales of fluid milk. In a buyers market, which is typical in areas of surplus milk production, the ability to undersell competition can be of vital importance. Although this differential was rationalized on the basis of reduced costs, it is likely that milk is being offered for sale in some cash-and-carry outlets which have higher costs than those that sell milk through retail stores. However, even with higher costs and lower prices, Class I sales at cash-and-carry outlets provide the producer with a better price for his raw product than he would receive were he to sell a relatively high proportion of it at surplus- or manufacturing-milk prices.

In the situation described here, the structure of the distribution system has been influenced by the operation of the milk stabilization laws, in that these established price differences have effects on the rate of entry and exit of the alternative forms of distribution.

No trends in seller concentration of the cash-and-carry operation can yet be observed because data have been available only since 1957. However, one noticeable characteristic is evident, even in large markets like Los Angeles: firm size, as measured by sales volume, rarely rises above 1,000 gallons per day. The explanation for this may be that the cash-and-carry sales depend on consumer density within a limited driving distance. Since firm numbers have generally increased, and since firms tend to be small, seller concentration has probably decreased over the past several years.

Processor-retailer integration

Retailer-owned processors began operating about a decade before state price

control was initiated. In 1929, the largest food store chain in California started its own fluid milk processing facilities. Two more similar operations came into existence in 1932. Reasons for this development may lie in technological conditions and market conditions.

Technological conditions include opportunities to streamline physical operations or increase the operating efficiency by shifting the decision-making function from the market to the firm. For example, physical functions performed in wholesale delivery of fluid milk are conventionally determined by market forces. In the competition for wholesale accounts, a precedent has been established by which the route man services the store dairy case. Thus, the services of specialized delivery equipment and personnel are tied in with the performance of functions which might otherwise be carried on by store personnel. Although these services are provided "free" by the seller, they must in the long run be borne by the firm providing the services. The reorganization of physical functions to permit the route man to make dock deliveries while the dairy display case is stocked by store personnel may effect significant savings in the aggregate.³⁰ In the face of institutional resistance, such reorganization may be possible only when control of the whole operation falls within the scope of a single firm's decision-making unit.

In addition to advantages through reorganization, vertical integration may reduce uncertainty. When a processor can depend upon a stable outlet for his production, he may be able to plan more effectively. For example, he may utilize processing and distributing capacity to a greater extent, or achieve lower average costs by using a plant which is designed

³⁰ During 1961, the California Bureau of Milk Stabilization held hearings to consider the possibility of "limited service delivery." At these hearings, testimony was presented on the size of savings that could be realized by processors if some of the functions usually performed by route men were shifted to store personnel. Subsequent to the hearings, the state pricing agency issued minimum resale price orders for many major markets which provided for an additional discount where customers agreed to accept such limited services.

to operate at optimum rates rather than one constructed especially for flexibility.³⁷

Market conditions which develop pressure for vertical integration stem largely from an opportunity to eliminate or consolidate services. For example, a large regional food store may procure its fluid milk from perhaps 20 or 30 local processing firms. With several thousand items handled in the store, reduction of the necessary procurement sources may result in a considerable saving. Vertical integration may also reduce costly services by eliminating promotion and other selling activities. This does not mean that a vertically integrated firm may not find it profitable to advertise and promote its "private label" brand of milk, but it may eliminate the promotion costs ordinarily incurred by a conventional processor to induce a retail outlet to handle his product.

Elimination of some selling costs and the advantages of reorganization of physical functions and services were probably the main reasons for the early development of vertical integration. To date, the movement has been specialized primarily in retailer-owned processing systems. After the first three large chains had integrated their fluid milk supplies by 1932, and the Desmond Act of 1937 had established resale prices for fluid milk, two more integrated systems were organized by retail store organizations in 1941 and 1948. These were similar to the earlier organizations except that they were jointly owned by several retail store firms. Integration during this time period was probably a reaction to the "flat-

price" system made effective by the pricing agency, whereby low-cost customers were prevented from sharing in savings resulting from large volume. By integration, available savings could be "captured" in the form of the profits accruing to owners of the processing facility.³⁸ These five integrated supply sources constituted 9.9 per cent of the California wholesale market in 1950; since then, four more integrated supply sources have been organized and one has been dissolved. By 1961, the annual volume sold through retailer-owned processors exceeded 46 million gallons, or 16.1 per cent of total wholesale fluid milk sales. Trends in the share of wholesale sales through integrated organizations from 1950 to 1961 are shown in table 16.

What effect has this development in processor-retailer integration had upon competition in the market for wholesale fluid milk? The situation is similar to the trend of livestock marketing away from central or "terminal" markets. Increased grower-processor coordination in hog marketing through "direct buying" met considerable opposition on grounds that it limited competition in the market.³⁹ The general argument has been that the movement away from the central market gives the buyer a favorable position in his bargaining power. Shepherd, however, points out that this type of vertical integration reduces demand and supply in the market by precisely the same amount and therefore has no effect on competition in the market when market knowledge of sellers and buyers is identical.⁴⁰ In other words, an increase in

³⁷ The choice of these terms is meant to be coincident with the concept of "flexibility" as developed by George Stigler, "Production and Distribution in the Short Run," *Readings in the Theory of Income Distribution: Selected by a Committee of the American Economic Association* ("Blakiston Series of Republished Articles on Economics," vol. III; Philadelphia: The Blakiston Company, 1949), pp. 119-142.

³⁸ Further expansion of this can be found in CLARKE, p. 9-13, footnote 19.

³⁹ A. A. DOWELL and K. BJORKA, *Livestock Marketing* (New York: McGraw-Hill Book Co., Inc., 1941), p. 46.

S. H. FOWLER, *The Marketing of Livestock and Meat* (Danville, Illinois: The Interstate Printers and Publishers, Inc., 1957), p. 340.

GEOFFREY SHEPHERD, "Central Markets: Changes in Structure," *Marketing: The Yearbook of Agriculture, 1954* (Washington: U. S. Government Printing Office, 1954), p. 57.

⁴⁰ Shepherd, footnote 39.

Table 16
MARKET SHARE OF RETAILER-OWNED PROCESSORS IN CALIFORNIA
WHOLESALE FLUID MILK MARKETS, 1950-1961

Year	Retailer-processor output	Total wholesale output	Retailer-processor share	Number of retailer-processors included
	gallons		per cent	
1950.....	16,882,744	172,561,657	9.9	5
1951.....	19,850,778	189,278,621	10.5	5
1952.....	23,733,496	205,091,285	11.6	5
1953.....	26,134,978	210,393,054	12.4	5
1954.....	27,401,983	209,867,218	13.1	5
1955.....	30,081,378	223,299,764	13.5	7
1956.....	35,061,556	246,262,182	14.2	8
1957.....	40,013,766	266,286,197	15.0	8
1958.....	39,930,137	274,576,168	14.5	8
1959.....	39,388,100	280,561,567	14.0	8
1960.....	45,416,218	282,973,367	16.0	9
1961.....	46,483,271	288,678,934	16.1	8

Source: Compiled especially for this study from information provided by the California Bureau of Milk Stabilization.

vertical integration would reduce the volume passing through the market but would not affect competition, since both the supply and demand are affected by the same reduction in quantity.

In the California fluid milk processing industry, however, buyers and sellers are not equally affected by the trend toward integrated fluid milk suppliers. When such retailer-processor arrangements are developed, a part of the market for conventional processors is preempted; thus the competitive balance in the market may well be affected. Processing capacity is increased by the addition of the integrated processor, and a different raw product supply source is normally used. The conventional processors find themselves with excess raw product and processing capacity each time an additional part of the total wholesale market becomes integrated. To the extent that vertical integration affects the demand facing conventional processors, the degree of their market power is affected. This follows because the ability of con-

ventional sellers to restrict alternative sources of supply to the remaining buyers is reduced by the existence of excess raw product and processing capacity in the market.

No attempt is made here to deal with the equity problem between conventional processors and integrated processor-retailer groups. Conventional processors oppose captives because they have legal advantages under the present law, and the controversy becomes a matter of equity between these two groups. Ignoring the equity problem, the major interest in the integration movement at this point is in its effect on market structure and competitive behavior.

Product differentiation

Product differentiation increases and makes more inelastic the demand facing a particular seller relative to his competitors. It therefore has an important bearing upon entry conditions and hence affects relations between sellers and

potential rivals.⁴¹ This study investigated the impact of changes in this dimension of market power.

The wholesale market.—The meat-packing industry of the 1920's is a good example of product differentiation and the dominance of "major brands." But many changes have occurred in the food processing industries since that time, particularly the appearance of the large food retailer in the form of the super-market chain. According to Mehren, the importance of processor brands has been greatly reduced by the development of the current "large retailer" environment:⁴²

"...retailers have become large enough in some local or regional markets to develop their own merchandising policies and thus to require suppliers of some food products to sell to the retailers on a straight price-specification basis...[and] to adjust the terms of delivery and of services to the physical requirements of the new types of retailing."

"As the specifications of retailers become more stringent, the scope for product branding, promotion, and pricing policy by processors or other suppliers diminishes."

"While most retailers carry many packer brands in groceries, they say that no single regional or national brand must be carried in order to attract customers."

Buyers in the wholesale market (retail food stores) are marketing experts concerned with specifications rather than brands. The importance of brands is therefore derived mainly from the responses of final consumers who generally are not experts in product quality and therefore may associate quality differentials with different brands. In large part, the importance of processor brands has declined with the development of large supermarket chains because these have

often taken the responsibility for guaranteeing product quality and have convinced the consumers of this fact. At any rate, it seems clear that consumers' attitudes towards "major brands" have undergone changes for some products.

Such changes in attitudes would tend to reduce the importance of conventional processor brands. Although it is not possible to verify these changes by known research techniques, an attempt was made to evaluate the validity of this hypothesis. If it is found that processor brands have no effect on the purchases of consumers, product differentiation cannot be considered important in the relations between wholesale sellers and buyers.

Certain features of fluid milk and the way it is handled in sales through stores provide an excellent opportunity for investigating this subject: homogeneous products (physically and chemically), uniform price, and self-service selection. Competing brands of fluid milk are required by California law to meet standard sanitary requirements. Butterfat content is specified within the range of 3.5 per cent to 4.2 per cent, and most firms standardize milk to about 3.55 per cent butterfat. State law sets a minimum resale price, with the result that all firms sell at this same price. Under these circumstances, the only effect product differentiation can have must be in the quantities that can be sold on the market by an individual firm. This effect can be measured directly.

Selection among brands in the super-market is made with no personal assistance or supervision by store personnel. Therefore, purchase selections may be interpreted as random samples from a hypergeometric population except as they may be influenced by a quality

⁴¹ Bain, *Barriers to New Competition: Their Character and Consequences in Manufacturing Industries* (Cambridge: Harvard University Press, 1956), chap. 4, pp. 114-143.

⁴² George L. Mehren, "Market Coordination and Buyers' Requirements," *Policy for Commercial Agriculture: Its Relation to Economic Growth and Stability*, U. S. Congress, Joint Economic Committee, 85th Cong., 1st Sess., 1957, pp. 291, 292, and 295, respectively.

dimension of the display (an eye-level location of the first brand approached when following normal traffic flows within the store may be a "good" quality attribute of display space) or a brand preference (resulting from product differentiation of any type).

In this case, except for differences in quality dimensions of space or brand effect, proportions of a particular brand among purchases would be highly correlated with the proportions in which the brands are stocked. This situation may be represented by:

$$Y_{ij} = a + b(k_j) X_{ij}$$

where Y_{ij} represents the proportion of total sales of brand j in store i ; X_{ij} , the proportion of the total fluid milk display in store i allocated to brand j ; and k_j , a weight reflecting the extent to which brand j is differentiated. If $k_j = \text{one}$, for all j , there is no brand effect, hence no product differentiation. By testing the statistical hypothesis $k_j = \text{one}$, for all j , it can be determined whether or not product differentiation is important.^{42a}

This statistical model states that sales depend on quantity of space. This is consistent with the argument presented above. However, it may also be argued that the proportion of sales of individual brands is in fact determined independently of space allocations. Information concerning the nature of these allocations is not available. For this reason, in this problem it must be assumed that X_{ij} is chosen independently of Y_{ij} , and quality of space is insignificant.⁴³

For this analysis, the proportion of

space allocated to each brand stocked was measured and the proportion of sales of each brand was observed during a six-hour period in a random sample of 54 of the 318 supermarkets in the Alameda-Contra Costa County area.⁴⁴ Of the 54 supermarkets observed, 22 were supplied by a single processor. Only the remaining 32 stores, having more than one supplier, could therefore be used in the space-sales analysis. In the regression analysis that was applied, the number of observations per store was the number of brands handled minus one.⁴⁵ The 32 stores used in the analysis contributed 59 observations.

Under the hypothesis that $k_j = \text{one}$, space allocation explained 60 per cent of the variance in sales. Where k_j was assigned the space-sales ratio for brand j (the brand effect), space allocation modified by brand effect explained 73 per cent of the variance in sales. The hypothesis that brand effect was unimportant could be rejected with a high confidence level.

It follows, therefore, that this fact will have some influence upon the relations between wholesale sellers (processors) and wholesale buyers (food stores). The influence of brands in this wholesale market does not necessarily give the processor of favored brands a high degree of market power, but neither can it

⁴⁴ Supermarkets refer to food stores with annual sales volume over \$375,000. Data concerning food stores by annual volume were obtained from the 1960 revision of the San Francisco Examiner Grocery Route List for Alameda and Contra Costa counties.

⁴⁵ The reason for this decision was that, since the variables were measured in proportions, when all but one had been considered the remaining observation had already been specified, as the value it must take was the residual proportion.

^{42a} For a detailed discussion of the measurement of product differentiation, see D. I. PADERBERG, "The Space-Sales Ratio as a Measure of Product Differentiation," *Journal of Farm Economics*, Vol. 46, No. 1, February 1964, pp. 173-178.

⁴³ It may be argued, of course that sales of each brand are a function of the particular clientele and their preferences—that proportions of sales are correlated with proportions of space, because the supermarket personnel knows what the customers want and stocks brands in that proportion which will satisfy their tastes. This would represent no problem in a controlled experiment because X_{ij} can be chosen at random. In a problem for which the X_{ij} 's are chosen by market forces, it is possible to specify causal direction only by understanding the determinants of the choice of X_{ij} .

be entirely ignored. This influence may have declined over the past decade or so, but the analysis presented in this bulletin does not measure changes over time.

The retail market.—In the processor retail market, as previously indicated, the product is made up of personal services to a much larger extent than in the wholesale market. The retail route man himself serves to differentiate the product he delivers from products offered

by other companies. Products are also differentiated by brands. Neither of these types of product differentiation, although they may be important in buyer-seller relations, has been subjected to analysis in the present study. Therefore, nothing can be said about changes in product differentiation in the retail market except that any changes which may have occurred do not appear to be of great importance.

Conduct of Market Participants

Competition among sellers in a market is not only affected by market structure and legal and social controls, but also by market conduct—the “acts, practices, and policies” of sellers used in arriving at . . . what prices to charge, what outputs to produce, what selling costs to incur, what product designs to offer, and so forth.”⁴⁶ An industry comprised of a limited number of firms may illustrate this distinction. In one case, each firm in the industry makes its output decisions independently and thus decides for itself how much to produce at the price generated by market forces. Under these circumstances, the market performance of the industry, in terms of price and output, may be at a competitive optimum. In the alternative situation, all firms in the industry recognize their interdependence, and actions by one will influence the actions taken by the others. Under these circumstances, with or without direct collusion, the market performance in terms of price and output may be that of pure monopoly. Thus, with identical market structure, very different types of

competition and performance may be obtained, depending upon the conduct of the participants.

Many practices such as price fixing, price discrimination, and tying contracts have been declared illegal whenever they have served to lessen effective competition. There is some evidence that price policies in the dairy industry have at times taken the form of price wars followed by price enhancement by the remaining firms or by geographic price discrimination.⁴⁷ This pattern of conduct is illegal when minimum prices are set by law. In the California fluid milk industry, therefore, the price control program—to the extent it has been effective—has substantially reduced the possibility for industry-determined price policies or practices.

The cost and price conditions prevalent in this market—unit costs that decline with increases in plant volume and prices that are unaffected by plant volume—suggest expanding plant and firm volume. This requires the invasion of competitor’s accounts, which may be attempted by nonprice competition. Such practices, however, are also controlled in California, for the Agricultural Code specifies several “unfair practices,” including the giving of rebates, gifts, loans

⁴⁶ Bain, *Industrial Organization*, p. 266.

⁴⁷ U. S. Congress, House, Special Subcommittee of the Select Committee on Small Business, *Hearings, Small Business Problems in the Dairy Industry*, 86th Cong., 1st-2d Sess., 1959-60, Pursuant to H. Res. 51, pp. 16-33.

of cash or equipment, and financial assistance in advertising.⁴⁸

Because of the many legal restrictions information about the actual existence of these practices is unobtainable. For this reason, long-range changes in conduct of market participants cannot be evaluated. It is of interest, however, to summarize what can be observed about the nature of market conduct at the present time.

Wholesale market participants

Wholesale milk processing firms as well as their accounts are usually large. Their terms of trade are often centrally determined for multistore and multiplant operations. Negotiators on both sides are well informed about supply and demand conditions. Product differentiation and personal relations tend to be of minor importance, while matters of equity loom large. When the various industry segments are characterized by excess production and excess processing capacity, one wholesale customer may substantially affect the profit account of an individual firm. Since the buyer (supermarket chain) is in control of the scarce "resource"—namely, the sales outlet—he is in a favorable negotiation position. The processors, motivated to expand their output by the low marginal cost associated with available unused capacity, are in a relatively weak bargaining position. Most forms of price and nonprice concession are illegal in California, but difficult to detect. Since the consequences of conviction may be minor compared with the chance of gaining or maintaining a large account, violations are to be expected.⁴⁹

It is likely that changes in the industry structure previously discussed have influenced market conduct of wholesale participants. The increased number of supermarket chains, the increase of cash-and-carry operations, and the increasing imbalance between Grade A raw milk production over consumption requirements have probably all contributed to the weakened position of the conventional wholesale processor and have no doubt been responsible in large measure for the increasing frequency of violations in recent years.⁵⁰ If so, this would represent a deterioration in the market conduct dimension of the California fluid milk industry.

Retail market participants

Competitive practices among retail market participants may be quite different from those in the wholesale market. Since the size of the typical retail account—the household—is small, there is little incentive to make illegal price or nonprice concessions. Product differentiation in service, sales personality, and real and mythical quality aspects of the product appear to be more effective. Competitive practices in home delivery include door-to-door selling with telephone follow-ups. In cash-and-carry sales, service and convenience of location are the main competitive factors. None of these practices is influenced by big business, high finance, or automation. Consequently, there has probably been little change in competitive practices in the retail market for fluid milk during the last two decades.

⁴⁸ California, *Agricultural Code* (1961), Div. 6, c. 17, art. 6, sec. 4280.

⁴⁹ The most powerful enforcement tool available to the California Bureau of Milk Stabilization is its authority to revoke or suspend the license of a processing firm. In most cases of minimum resale price violations, the penalty is a fine. The maximum fine for each violation of the "unfair practices" section of the *Agricultural Code* is \$500. In individual cases, the total fines assessed against a company in a single legal action have commonly amounted to \$5,000 and, in some instances, to as much as \$10,000 to \$15,000.

⁵⁰ A major example is of current concern. A large dairy firm has been charged with being implicated in a multimillion dollar bank loan to a grocery chain which could not have been made without assistance of the distributor. A "Complaint for Civil Penalties and for Injunction" was filed on March 29, 1963, in *Charles Paul v. Foremost Dairies, Inc. et al.*, Case No. 816150.

Competition and Performance

Changes in competition

The main purpose of investigating changes in the wholesale and retail market environment is to evaluate the influence of these changes on the degree of competition among the market participants. In a purely competitive market environment, participants have no discretion over price or other profit-determining variables beyond the physical operation of the firm. Therefore, all participants bargain on equal terms in the market. When features of the market environment allow participants to exercise some degree of control over profit-determining variables, the degree of competition may vary through many gradations from pure competition to pure monopoly.

Although recourse to economic theory gives some basis for evaluating the influence of changes in characteristics of the market environment upon the behavior of market participants—such as the relation between an increased concentration of sellers and a greater tendency toward collusive price setting—little is known about the importance of one environmental feature relative to another. For example, with all other things remaining the same, increased seller concentration would be expected to lessen competition among sellers, whereas lowered entry barriers would increase competition among sellers; but no guide has been provided for evaluating the relative importance of increased seller concentration and lowered entry barriers. Therefore, conclusions must be drawn based on judgment and observations of all pertinent environmental features in a particular industry.

The wholesale market

During 1950–1960, the primary change in the California wholesale fluid

milk market which would tend to decrease competition among sellers has been the increased seller concentration; market shares of the largest firms have increased while the total number of competitors has decreased.

During the same period, the changes which would tend to increase the degree of competition among sellers (or reduce market power of sellers) may be summarized as follows:

1. The wider distribution radius made possible by single-service containers and improved transportation techniques have increased the number of sellers participating in most metropolitan areas.

2. Excess production at the farm level over consumption has lowered entry barriers, encouraging potential competition.

3. The reorganization of the food store industry has apparently reduced somewhat the opportunity to differentiate products.

4. The trend toward the replacement of conventional sellers with integrated supply systems has limited sellers' ability to restrict alternative supply sources.

The measure of wholesale seller concentration previously developed concerns all wholesale sellers in California. Assuming that the relevant market for wholesale sellers throughout 1950–1960 included the entire state, this is the appropriate measure of seller concentration. These measures indicate that seller concentration has increased (table 12). Between 1950 and 1960, the market share of the largest four firms increased by 7.4 per cent of the total market, that of the largest eight firms by 9.4 per cent, and that of the largest 20 firms by 7.9 per cent. That these percentages alone do not indicate the truly dynamic conditions which exist in this industry is demonstrated by the following. By 1955, the firm which ranked second in sales had dropped to

third rank; the firm which in 1950 had ranked fourth had been displaced in this position by the firm which had ranked eighth. Between the 1955 and the 1960 period, the firms which in 1955 had ranked first, second, and third retained their relative positions, while the firm which had ranked fourth in 1955 was displaced by the fifth-ranking firm.

Still another measure of changes in the relative importance of firms within the state was based on a classification of "major independent" firms. This grouping was arbitrarily defined as those firms operating plants with daily average sales in excess of 3,000 gallons, but excluding plants operated by regional and national multiplant firms. During 1950-1960, the market share of these firms increased by 17.7 per cent—a relative increase of more than 60 per cent in the market share controlled by these firms.

All other things remaining the same, increased seller concentration would be expected to affect the behavior of sellers relative to each other. As large sellers acquire a greater share of the market, they typically acquire more power relative to other sellers, and therefore can more readily compete. Other changes, however, may also influence the competitive relationships among sellers. The opportunity to establish a "preferred" brand may give "differentiated" sellers market power relative to other sellers. The opportunity to differentiate products varies as the characteristics of the firms which make up the industry change. In the California fluid milk industry, and particularly in the retail food store segment, changes over the past decade have decreased the opportunity for differentiation and have to this degree reduced the power of large processors relative to small processors.

Scale economies in wholesale process-

⁵¹ The retail food store revolution may explain some reduction in the relative size of the home-delivery channel of distribution, but it has apparently not affected the structure of the retail processing industry.

ing have given the large processors some insulation relative to prospective entrants because of the investment barrier to entry. Since the middle 1950's, however, more Grade A milk has been produced than is needed for fluid uses. Groups seeking outlets for their production have provided investment for the organization of wholesale "captive creameries." This has had the effect of lowering the traditional entry barriers and hence reducing the power of large sellers.

How have these changes affected competition between buyers and sellers? Assuming that the bargaining position of buyers remained unchanged, increased sellers concentration could result in a situation where sellers might possibly be stronger relative to buyers. The fact is, however, that concentration of buyers during the period under study increased more rapidly than did concentration of sellers. This would suggest that when only changes in concentration of sellers and buyers are considered, the bargaining position of sellers has not been strengthened relative to that of buyers. Furthermore, other changes over the past decade—such as the lowering of entry barriers and the decreased opportunity to differentiate products—would have a tendency to weaken the bargaining power of sellers relative to buyers. It would appear, therefore, that the strength of sellers relative to buyers has decreased over the years; and consequently the threat of possible exploitation resulting from processor consolidation may have, in fact, been more than counterbalanced by these other developments.

The retail market

The retail fluid milk market, being characterized by small business units, has been relatively unaffected by changes in technology and the retail food store revolution.⁵¹ Technological change has primarily affected processing, which is only a small part of retail home-delivery costs. The type of container used has not

changed appreciably in the last few decades.⁵² Factors affecting the degree of competition among retail processors include the trend toward wholesale operations and the surplus production of Grade A milk. Concurrent with the trend away from retail operations, average volume per firm tends to decrease, causing a cost-price squeeze. As a result, some firms will drop out. Conversely, when profits become more favorable in a particular market, participants will enter. Although firm numbers are not large in any one market, considering both home delivery and cash and carry, the relative freedom of entry and the competition with wholesale channels of distribution permit little market power to develop.

The relation between competition and performance

The performance of an industry is measured by the results of its operation in terms of prices, costs, output, and progressiveness. Economic efficiency in such terms is completely attained when conditions of perfect competition prevail or are approached. Scitovsky⁵³ points out that a perfectly competitive market makes ideal allocations of resources. Therefore, this model system may be regarded as a standard of economic efficiency.

It is for this reason, perhaps, that market performance is associated with the degree to which the industry approaches the optimum results generated under the perfectly competitive market. This may also explain why, in our system of anti-trust philosophy, the ill effects of various types of market conduct or structure are considered primarily as they influence competition. In this context, the "goodness" or "badness" of an industry is measured in terms of the degree of competition which exists among its market

participants. The question that now must be answered concerns the type of performance desired from the California fluid milk industry.

Definition of performance goals

Economic analysis aimed at improving market performance is motivated by the basic goal of economic efficiency and its resultant optimization of resource allocation and income distribution. This implies a measure of the extent to which the allocation of resources, the physical operations of production and marketing, and the value determination aspects of marketing are oriented toward consumer welfare as represented by the preference patterns of individuals.

To be sure, economic efficiency is only one factor contributing to social welfare; society may elect to achieve some other goal, and in so doing may adopt means which in themselves preclude an economically efficient utilization of resources. The goal chosen may be the protection of small businesses, or the stabilization of prices, or the maximization of producers' or processors' returns. Many examples of social choices are found in cases of government market control.⁵⁴ Although the economist cannot predict when these choices will be made nor sometimes even learn why they are made, the role of economic analysis in evaluating the economic efficiency of the market is generally not altered by such choices. Often, when constraints are imposed upon the marketing system to achieve some alternative goal, it becomes particularly important to determine the impact of

⁵² Although glass containers are still predominant in retail, home delivery, the half-gallon container has increased in use over the single quart in recent years.

⁵³ Scitovsky, footnote 9.

⁵⁴ A discussion of the motivation of marketing programs is found in SIDNEY HOOS, "The Contribution of Marketing Agreements and Orders to the Stability and Level of Farm Income," *Policy for Commercial Agriculture: Its Relation to Economic Growth and Stability*, U. S. Congress, Joint Economic Committee, 85th Cong., 1st Sess., 1957, p. 320, and GEORGE L. MEHREN, *Agricultural Market Control Under Federal Statutes*, University of California, Giannini Foundation Mimeographed Report No. 90 (Berkeley, 1947), p. 27.

these constraints upon economic efficiency. In most cases, therefore, economic analysis of market performance is oriented toward evaluating such efficiency.

The dimensions of most importance in evaluating the overall efficiency of the California fluid milk processing industry include (1) processing efficiency, (2) price-cost margins, (3) size of selling cost, (4) progressiveness of processing techniques, and (5) product quality.

Each dimension of performance may be investigated separately. There is no conflict in relating degree of competition with processing efficiency in general. There is every reason to expect participants to be motivated to strive for the most efficient operation whenever a high degree of competition exists. However, when economies of scale or of vertical integration provide the opportunity to increase efficiency, a large number of relatively small operations (atomistic structure) may not be conducive to the best performance in this dimension. This is particularly true in an industry such as fluid milk distribution, where an increased number of participants is bound to reduce the delivery density of each individual participant and so reduces efficiency by increasing costs.⁵⁵

In a highly competitive market, ease of entry and exit will stimulate price adjustment until prices approach production-distribution costs. This relationship between degree of competition and performance is based upon the assumption that price determination is a function performed by the market in which the degree of competition is being considered. This is not true of the California fluid milk industry, however. In this environment,

⁵⁵ For an example of how the multiplicity of sellers affects costs in milk distribution, see R. G. Bressler, *City Milk Distribution* ("Harvard Economic Studies," vol. XCI; Cambridge: Harvard University Press, 1952), especially Part IV, pp. 257-318.

⁵⁶ The possibility of a monopolistic processor group having control over price through political power is not considered here.

The degree of competition has no direct effect upon price-cost margins. Prices are established by the California Bureau of Milk Stabilization and are designed to reflect production-processing-delivery costs. These prices change as costs change, and the price-cost margin is independent of structural relationships among sellers.⁵⁶

Selling costs would be expected to be determined by the degree of competition among sellers. There would be no selling costs in a perfectly competitive market, but selling costs may be incurred when the market is less than perfectly competitive. If the degree of competition among sellers is increasing over time, performance in the selling cost dimension should be improved; that is, selling costs should be reduced. Here again, a unique situation exists in the fluid milk industry because prices are effectively controlled by government. When price adjustment is not permitted openly, there is a possibility of using selling cost allocations for secret price concessions to obtain or maintain accounts. The theoretical hypothesis that an increased degree of competition would reduce selling costs does not take into account this form of selling costs which may exist in this market.

Again, conventional theory suggests that a high degree of competition among sellers tends to promote processing efficiency; that is, when sellers lack market power, the emphasis and competitive advantage are shifted to the cost-reducing aspects of operations. Under these circumstances, a highly competitive industry would be expected to be progressive in the development of processing technologies. At least, there would be motivation to develop technical improvements. The problem is that technical development requires considerably more than motivation. It also requires intensively specialized research which in turn requires highly trained personnel and extensive specialized facilities. In view of the tremendous expense involved, being

“progressive” in processing techniques may be feasible only for large processing units. This circumstance makes it necessary to qualify the generalization that a high degree of competition is associated with progress in the development of new processing techniques.

Product quality refers to “how well the firms engaged design, determine the quality of, vary, differentiate, and progressively improve their products—all relative to that performance in these several regards which would achieve the best obtainable balance between buyer satisfaction and the cost of production.”⁵⁷ Among product variations which have become important in the California fluid milk market are home-delivery service, cash-and-carry service, retail store services, and concentrated fluid milk. When sellers have market power, they may be able to curtail or eliminate some types of service which give them no particular advantage.

Whenever a high degree of competition among sellers exists, these various types of service and products may open up a market otherwise not accessible, and thus a greater variety of services will be offered. Therefore, optimum performance requires the provision of these alternatives. A high degree of competition among sellers will generally assure good performance in this dimension.

In summary, an increasing degree of competition among sellers should generally assure improved performance in most dimensions. In this particular market, notable reservations to this generalization lie in the following areas:

- the extent to which processing efficiency is affected by scale economies,
- the degree to which price-cost margins are government controlled, and
- the extent to which progressiveness in processing technologies and product quality is affected by firm size.

⁵⁷ Bain, *Industrial Organization*, footnote 7, p. 397.

Performance of the industry

As indicated earlier, the analyses and observations made of the California fluid milk industry suggest that the degree of competition among sellers has remained virtually unchanged in the retail market and has not declined appreciably in the wholesale market. With the reservations outlined above, this degree of competition should assure a high level of market performance. We now direct attention to the kind of market performance actually returned by the existing system.

The perfectly competitive model of economic efficiency dictates that the standard both for price-cost margins—allowing for “normal” profit rates—and for selling costs is zero in the long run. No such standard of excellence is available for evaluating performance in terms of processing efficiency, progressiveness of processing techniques, or the various dimensions of output and product performance. In view of the fact that the state government has taken an active part in controlling the environment in which this market operates, it may be enlightening to compare market performance in this environment, whenever possible, with that in different types of systems.

With regard to product performance a distinct difference exists between the California market and other markets. The California market typically provides the following product-service combinations: “standard” grade (usually standardized near 3.5 per cent butterfat content) homogenized milk in paper containers; homogenized milk of more than 4.2 per cent butterfat content in paper containers; “3 to 1” concentrated fluid milk in paper containers; homogenized milk in glass containers (“standard” as well as “premium” grade in terms of butterfat content), both cash-and-carry and home delivery. Glass and paper containers are available in quart and half-gallon sizes. In addition, there are a very few instances of glass containers at wholesale and paper containers at retail as well as

cream-top milk at both retail and wholesale. This list of combinations includes the output of small local retail processing units as well as that of large national firms. Products requiring a high labor input are offered; namely, home-delivery and cash-and-carry operations, as well as products requiring lower labor but higher capital inputs.

In many other markets, cash-and-carry services have been eliminated by aggressive pricing policies of competitors.⁵⁸ Although the dairy store has survived in the Boston and Ohio markets, small processors have very often been forced out of business. Concentrated fluid milk, offered in California for several years, is unavailable commercially in any other market.

In the area of progressiveness in processing technologies, the California fluid milk market has been a pioneer in several respects. The adoption of paper containers often created opportunities for the expansion of volume which in turn made it feasible to adopt other new techniques such as bulk collection and high-temperature, short-time pasteurizers. By 1944 when nearly 60 per cent of the California fluid milk sales was packaged in paper containers, only slightly more than 10 per cent of total United States sales was so packaged. By 1952 the U. S. proportion had risen to only 39 per cent,⁵⁹ whereas in California it was more than 60 per cent.

Consistent with the assertion that the use of paper containers in California led the way to the adoption of other high-volume techniques, there is evidence that California also pioneered the adoption of

bulk handling in farm milk assembly. This procedure, adopted in California in the late 1930's and in general use throughout the state by 1948,⁶⁰ was not introduced in most midwestern and eastern markets until the middle 1950's.⁶¹ In a recent summarization of changes in milk processing and distribution, a member of the U. S. Agricultural Marketing Service indicated that "more distribution innovations have started in California than in most other states."⁶² Taking into account the several technological developments described, it may be concluded that this market compared favorably with other markets in technological progressiveness.

Unfortunately, it is impossible to directly compare the performance of the California market with that of other markets in processing efficiency, price-cost margins, or size of selling costs. Some details regarding these margin components are available for the California market, prepared by state personnel in accordance with the California Bureau of Milk Stabilization cost accounting procedures. Comparable data for other markets are not available, and the use of different cost accounting systems further precludes direct comparisons. It can be observed, however, that one effect of these three dimensions of market performance is to influence processor margins. Although available data do not permit separate comparisons of each of these dimensions, it is possible to com-

⁵⁸ U. S. Congress, House, Special Subcommittee of the Select Committee on Small Business, footnote 47, Part IV, pp. 363-737.

⁵⁹ *Outer-Market Distribution of Milk in Paper Containers in the North Central Region*, Purdue Agricultural Experiment Station Bul. 600, North Central Regional Pub. 39 (Lafayette, 1953), p. 11.

⁶⁰ U. S. Economic Research Service, *Changes in Milk Processing and Distribution*, by A. G. Mathis, 1960, 6. 20.

⁶¹ Bulk farm milk collection was introduced into the St. Louis and Wichita markets in 1954. See Richard F. Fallert and Stephen F. Whitted, *Impact of New Milk Collection System on the St. Louis Dairy Farmers*, Missouri Agricultural Experiment Station Bul. 719 (Columbia, 1959), p. 4; and Paul L. Kelley, *Route Organization and Bulk Milk Assembly Costs in the Wichita Market*, Kansas Agricultural Experiment Station Agricultural Economics Report 82 (Manhattan, 1958), p. 1.

⁶² U. S. Agricultural Marketing Service, footnote 60, p. 9.

pare performance in different markets by considering these three dimensions in the aggregate. While questions concerning market performance cannot be answered precisely and conclusively, some available measures appear to be appropriate. Of these, the most direct compare consumer price levels within one market with those which exist within markets having different economic and institutional organizational structures.

Such comparisons can have only limited value for markets which differ in size, geographic location, and other conditions affecting cost and efficiency. To be completely valid, actual prices ought to be compared with some ideal or perfect prices in each market, but this is impossible because ideal price cannot be effectively determined. Prices actually paid by milk customers differ in various markets because of differences in basic prices for the fluid milk at the producer level. The effect of this factor, however, can be eliminated by comparing "price spreads"—the amount of money retained by the processor or by the storekeeper for the services he performs in processing, delivering, and selling milk. But many other differences cannot be eliminated. For example, it is known that wage rates and other important cost factors are not constant from market to market. And natural conditions, such as topography and delivery density, also vary from market to market. These factors will affect route volumes and resulting distribution costs. Furthermore, variations in typical volumes per customer, especially in the wholesale trade, also tend to influence average cost. For these and similar reasons, it is not valid to conclude that milk distribution in one market is more efficient than in another—or that prices are "too high" or "too low"—simply because typical price spreads (or prices) may be higher or lower. All of these limitations

must be considered in any price comparisons, including those that follow. While the influence of some of these differences may average out, it must be recognized that the comparisons are far from perfect.

Prices for fluid milk markets throughout the United States are reported monthly in the *Fluid Milk and Cream Report*, a regular publication of the Statistical Reporting Service, U. S. Department of Agriculture. These reported price data include dealer buying prices for milk for fluid purposes for a stated butterfat content, the butterfat differential (the amount added to or subtracted from the dealer's buying price for each change of one tenth of 1 per cent of butterfat content of milk purchased), the selling prices at various levels of distribution, and the average butterfat test of the most commonly sold milk. Appropriate price spreads or margins can be calculated from the above price information. When these margins are compared among various levels of the distribution system, some indication may be obtained as to the quantity of resources required in each market to perform essentially similar marketing functions.

However, margins computed from these published price reports are measured only in "local" dollars, implying the assumption that a given unit of money represents a constant quantity of resources at all locations, or that price levels are the same at all locations. Such an assumption lacks validity, however, for the general price level may be higher in some parts of the country than in others. Although information on geographic price variations is not complete, some studies have been made by the U. S. Bureau of Labor Statistics of comparative price levels in 20 large cities.⁶³ This index of price levels may be used to eliminate the effect of geographic price variations

⁶³ U. S. Bureau of Labor Statistics, *Monthly Labor Review*, August, 1960, pp. 785-808. Prices observed in this study are at the retail level. Wholesale prices would theoretically be a more accurate representation of the different quantities of resources represented by a unit of money

Table 17
DISTRIBUTION MARGINS FOR 20 MARKETS: FLUID MILK IN QUART CONTAINERS
ADJUSTED FOR GEOGRAPHIC PRICE DIFFERENCES, 1962

Market	Price index	Retail margin delivered*	Wholesale margin†	Store margin‡	Wholesale plus store margin
	1	2	3	4	5
		cents			
Boston.....	103	15.0	9.0	2.8	11.8
New York.....	97	19.8	12.6	2.0§	14.6§
Philadelphia.....	96	16.0	11.3	0.5	11.9
Pittsburgh.....	101	13.9	11.3	1.6	12.9
Scranton.....	93	15.6	11.8	1.6	13.4
Cincinnati.....	99	14.2	13.2	2.3	15.5
Cleveland.....	101	13.7	9.4	1.4	10.9
Chicago.....	107	20.4	15.1	0.5	14.7
Detroit.....	99	14.8	—¶	—	15.4
Minneapolis.....	101	14.6	—	—	11.8
Kansas City.....	97	16.2	9.1	3.4**	12.6
St. Louis.....	102	19.4	—	—	—
Baltimore.....	93	18.8	16.0	1.7	17.8
Washington.....	100	17.2	14.2	1.5	15.7
Atlanta.....	92	12.9	10.7	3.3	14.0
Houston.....	87	16.7	12.4	—1.1††	13.2††
Seattle.....	107	13.8	11.4	2.3	13.7
Portland.....	101	13.3	10.8	1.5	12.3
Los Angeles.....	102	15.1	9.7	2.0	11.6
San Francisco.....	103	17.4	11.1	1.9	13.0
Los Angeles-San Francisco average.....	—	16.2	10.4	2.0	12.3
Average of other markets.....	—	15.9	11.9	1.7	13.6
Range of adjusted margins.....	—	12.9-20.4	9.0-16.0	—1.1-3.4	10.9-17.8

* The difference between the price paid the farmer and the delivered price paid by the consumer. Prices are adjusted for service charges and discounts on the basis of 3-quart average delivery, 9 quarts per week, or 45 quarts per month.

† The difference between the price paid the farmer and the price received from stores.

‡ The difference between the delivered price to the store and the price paid by the consumer at the store.

§ Seven-month average.

|| Eleven-month average.

¶ Dashes indicate no data available.

** Eight-month average.

†† Nine-month average.

Sources:

Col. 1: U. S. Bureau of Labor Statistics, **Monthly Labor Review**, August, 1960, p. 788.

Cols. 2-9: Calculated from price data reported in U. S. Agricultural Marketing Service, **Fluid Milk and Cream Report**, January-December, 1962, Table 1.

much as the general price level index is used to eliminate the effect of inflation over time. After margins of the 20 markets have been divided by this geographic deflator, they should reflect the quantity of resources required in each of the

markets to perform the marketing services.

The adjusted margins for the year 1962 for milk sold in paper quart and half-gallon containers are shown in tables 17 and 18. Considering the adjusted

at different locations. Although the wholesale price information is not available, it would be expected to be highly correlated with the retail price series and, therefore, may be represented by this family budget series.

Table 18

DISTRIBUTION MARGINS FOR 20 MARKETS: FLUID MILK IN HALF-GALLON CONTAINERS
ADJUSTED FOR GEOGRAPHIC PRICE DIFFERENCES, 1962

Market	Price index	Retail margin delivered*	Wholesale margin†	Store margin‡	Wholesale plus store margin
	1	2	3	4	5
		cents			
Boston.....	103	25.4	11.9	4.6	16.5
New York.....	97	—§	—	—	28.2
Philadelphia.....	96	29.5	19.0	2.6	21.6
Pittsburgh.....	101	24.8	19.2	3.5	22.6
Scranton.....	93	—	—	—	—
Cincinnati.....	99	26.5	24.4	2.6	27.0
Cleveland.....	101	23.5	17.8	1.9	19.7
Chicago.....	107	33.0	27.5	1.9	25.6
Detroit.....	99	23.6	—	—	19.3¶
Minneapolis.....	101	24.9	—	—	18.1
Kansas City.....	97	28.3	16.7**	6.5**	23.3
St. Louis.....	102	28.4	—	—	—
Baltimore.....	93	31.0	26.8	2.2	28.9
Washington.....	100	30.2	21.5	0.1	21.6
Atlanta.....	92	24.7	21.2	5.6	26.8
Houston.....	87	29.0	23.0	—0.9**	21.5
Seattle.....	107	28.9††	21.6‡‡	3.7‡‡	25.4
Portland.....	101	26.3	20.7	2.5	23.1
Los Angeles.....	102	29.2	18.4	3.9	22.3
San Francisco.....	103	30.8	21.2	3.9	25.0
Los Angeles-San Francisco average.....	—	30.0	19.8	3.9	23.7
Average of other markets.....	—	27.4	20.9	2.8	23.1
Range of adjusted margins.....	—	23.5–33.0	11.9–27.5	—0.9–6.5	16.5–28.9

* The difference between the price paid the farmer and the delivered price paid by the consumer. Prices are adjusted for service charges and discounts on the basis of 3-quart average delivery, 9 quarts per week, or 45 quarts per month.

† The difference between the price paid the farmer and the price received from stores.

‡ The difference between the delivered price to the store and the price paid by the consumer at the store.

§ Dashes indicate data not available.

|| Ten-month average.

¶ Eight-month average.

** Nine-month average.

†† Eleven-month average.

‡‡ Six-month average.

Sources:

Col. 1: U. S. Bureau of Labor Statistics, **Monthly Labor Review**, August, 1960, p. 788.

Cols. 2-9: Calculated from price data reported in U. S. Agricultural Marketing Service, **Fluid Milk and Cream Report**, January-December, 1962, Table 1.

wholesale processor margin (the difference between the price paid to farmers and the price received from stores), the two California markets — Los Angeles and San Francisco — averaged 1.5 cents per quart container and 1.1 cents per half-gallon container less than

the average of the other markets considered. On the other hand, the same margins for retail home-delivered milk averaged slightly higher in the California markets than in the combined other areas by 0.3 cents for quart containers and by 2.6 cents for half-gallon contain-

ers. Store margins (the difference between the delivered price to stores and the price paid by consumer) were also slightly higher, on the average, in the California markets—by 0.3 cents on quart containers and by 1.1 cents on half-gallon containers. The differences between average margins in California markets and those in the other metropolitan areas are small, particularly when contrasted with the full range of these differences. It may, therefore, be concluded that differences in these averages are probably not significant. Furthermore, some of these differences also reflect local conditions of a temporary nature, as in Houston, where the store margin averaged a negative amount during the year under observation, probably as a result of a price war which brought the store price to consumers down to a level below that reportedly paid by the retailer.

A further evaluation of the performance of the California fluid dairy industry may be made by a comparison, over time, of some type of index which reflects movements in milk price spreads with an index of movements in the price levels of related items. For this purpose, indexes of the “spreads,” or margins, of both retail and wholesale milk for the Los Angeles market were developed, using the period 1957 through 1959 as a base (1957–1959 = 100). Since both dealers’ buying prices and retail home delivery prices are reported in the *Fluid Milk and Cream Report* for an average of 25 cities throughout the country, a similar index could be computed from these data. This has been labeled the “U. S. Retail Milk Price Spread” index. Finally, still another index was calculated from data published in the *Marketing and Transportation Situation* relating to the “Market Basket of Farm Food Products.” The basis for this index were the farm-retail spreads for farm food products regularly reported by the Economic Research Ser-

vice of the U. S. Department of Agriculture.

These four indexes of movements of price spreads, by months, for the years 1948 through 1962 are shown graphically in figure 7. Based on changes from the base period, 1957–1959, both the Los Angeles retail and wholesale price spread indexes have risen less rapidly than has the United States retail milk spread index. Both Los Angeles milk indexes have moved in general conformity with the market basket index series, although they did not move upward as rapidly as the market basket series during the early 1950’s, nor in the period from mid-1955 through 1957. On the other hand, since 1959 the Los Angeles milk spread indexes have tended to advance and remain at somewhat higher levels than has the market basket index.

To summarize, the processing efficiency, price-cost margins, and the size of selling cost dimensions of performance in the California fluid milk industry appear to be reasonably “in line” with those of other marketing systems. Its progressiveness in processing techniques and product designs also compares favorably with that of other marketing systems. In view of these observations, it would appear that the performance of the California fluid milk industry has not been adversely affected by the observed structural changes in the market environment. This conclusion establishes the basis for dismissing the premise that the observed structural changes within the fluid milk industry in California posed the threat of monopolistic exploitation. The evidence presented, while necessarily limited, points to present performance of the industry at an “acceptable” level, but the analysis fails to give any indication as to whether, through structural or institutional alteration, future performance of the industry can be improved. This broader objective, however, is beyond the scope of the present report.

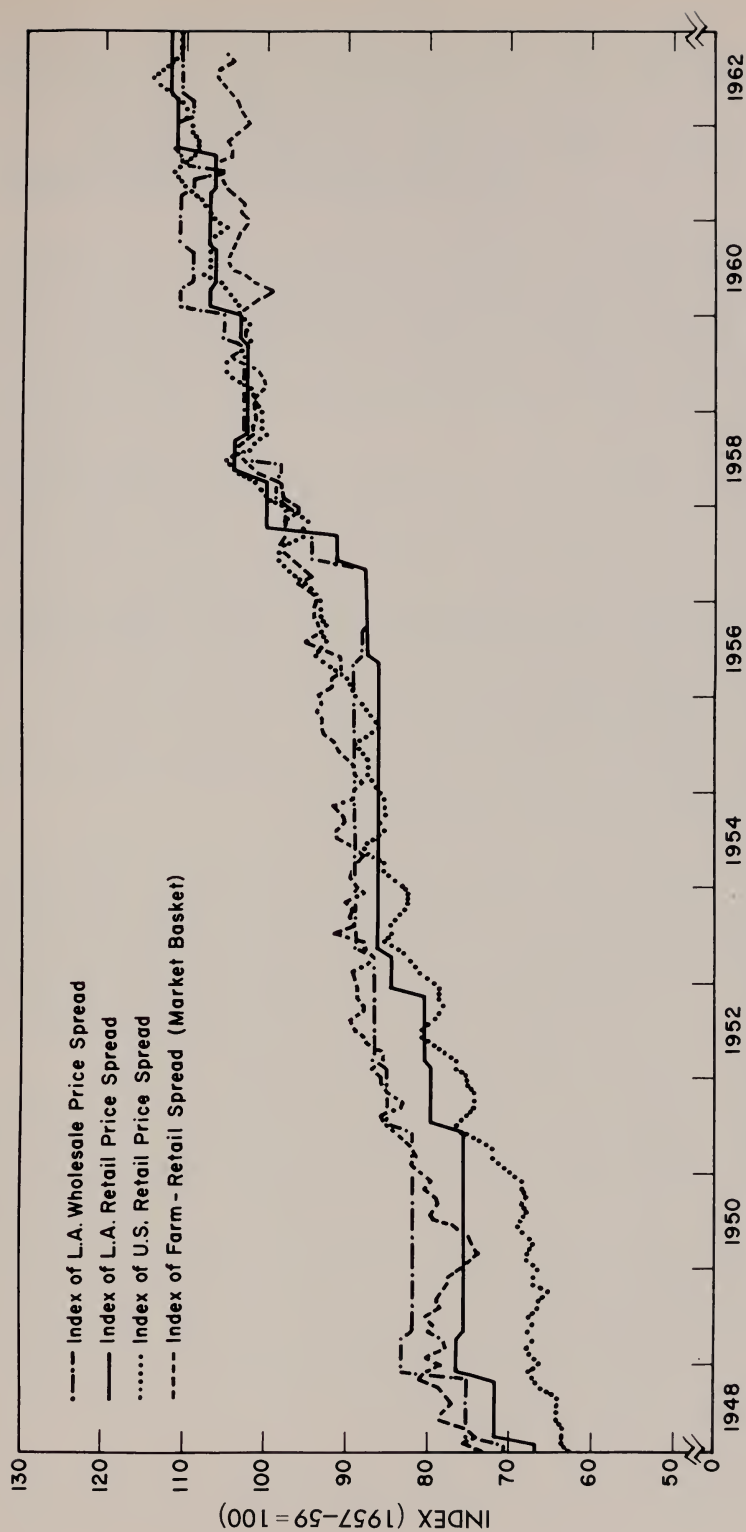


Fig. 7. Indexes of price spreads for the Los Angeles wholesale milk, Los Angeles retail milk, and market basket of farm food products (farm-retail spread), 1948-1962, by months.

Appendix A: Estimation of concentration curves of California Supermarkets, 1950-1958

A concentration curve shows graphically the relationship between number of firms and cumulative market shares of firms ranked from largest to smallest. The shape of these concentration curves indicates the size distribution of firms within an industry. For example, when all firms within an industry are of equal size, the concentration curve is a 45-degree line running through the origin. An indication of changes in the size distribution of firms may be obtained by comparing the concentration curves of an industry over time.

The information given in tables 5 through 8 gives directly three points on these concentration curves: First, they must start through the origin, because zero firms can contribute only zero share of the market. Second, the total number of firms in the industry must contribute 100 per cent of the industry output. An additional point is obtained by using the concentration ratio for the largest 10 firms (table 8). This information adequately describes changes that have occurred in the size distribution of a very small number of the larger firms. It is of interest for our problem also to investigate the nature of growth patterns of the group of smaller chains, since the larger firms are essentially all supplied by captives. Details concerning the number of chain store firms and the number of stores they operate, by years, are given in table 14. No information concerning the market share of these smaller chains is available, however.

It is known that the average of annual sales of all stores is much below the average per chain store outlets for which data are available. For example, in 1958 the average of annual sales of *all* food stores in California was \$424,000, while the average of sales per unit of the largest 10 chains was \$1,375,169, or more than three times greater. It seems reasonable to assume that the average of annual sales of all *chain* store units is nearer to the average for the largest 10 than to the average of all stores. On a national basis in 1958, the annual sales per store of all chain store outlets were 83.6 per cent as large as the annual sales per outlet of the largest 10 chains.⁶⁴

By applying this weight of 0.836 to the average of annual sales per outlet of the largest 10 firms in order to estimate the average of sales of all chains, an additional point on the concentration curves may be obtained. Computation of this data for 1950, 1954, and 1958 is shown in table A-1. It is possible that the use of the 1958 national weight for other years may bias this estimation procedure, for casual observation suggests that some of the smaller chains of recent origin have higher annual sales per store than the largest chains. If the annual sales per store of all chains have in fact been gaining over the past few years in relation to the annual sales per store of the largest 10, this estimating procedure understates the increase in market share of all chains from 39.0 per cent to 59.5 per cent as shown in table A-1.

⁶⁴ This Week Magazine, footnote table 7, p. 53.

Table A-1
ESTIMATED MARKET SHARE OF ALL CHAIN STORE OUTLETS
CALIFORNIA, 1950, 1954, AND 1958

Year	Annual sales per outlet, largest 10 chains	Estimated annual sales per outlet, all chains	Number of chain store outlets	Number of chain store firms	Total grocery store sales	Market share of all chains
	1	2	3	4	5	6
	dollars				million dollars	per cent
1950	645,549	539,679	1,849	232	2,557	39.0
1954	1,099,267	918,987	1,982	311	3,292	55.3
1958	1,375,169	1,149,641	2,291	356	4,430	59.5

Sources:

Col. 1: Table 7.

Col. 2: Column 1 weighted by 0.836.

Cols. 3, 4, and 5: Table 5.

Col. 6: Column 2 times column 3 divided by column 5.

Appendix B: Procedures for developing the population of entrant and exant fluid milk processing firms, 1950-1958

All firms which conducted bottling operations for raw or pasteurized fluid milk in the state of California during some part of the period January 1, 1950, to December 31, 1958, and which commenced or terminated processing operations in that time period were included in the population of fluid milk processors. In order to identify this population, a survey of available data was conducted.

Sources of published data

No published data are available concerning fluid milk processing firm numbers or entry and exit of such firms over time. The following sources, however, contain some information concerning the number of fluid milk dealers and fluid milk processing plants, by years.

1. Stewart Johnson, *Dairy Marketing* (Storrs: University of Connecticut, Department of Agricultural Economics and Farm Management, 1956). The number of licensed fluid milk dealers in California, including peddlers as well as processors, is given in this publication for the years 1950-1956. Each plant of a multiplant firm was counted as a separate entity. This series is shown in table B-1.

2. California Crop and Livestock Reporting Service, *California Dairy Industry Statistics . . . : Manufactured Dairy Products, Milk Production, Utilization, and Prices* (Sacramento, annual issues). This publication contains a series of numbers of fluid milk distributors in California for the years 1951-1957. The definition of these distributors indicates that only those with processing plants are included.

Table B-1
NUMBERS OF FLUID MILK DEALERS AND PROCESSING PLANTS
CALIFORNIA, 1950-1960

Year	Licensed dealers	Net change from previous year	Processing plants	Net change from previous year
	1	2	3	4
1950.....	2,181	—*	—	—
1951.....	1,701	—480	531	—
1952.....	1,752	51	483	—48
1953.....	1,651	—101	489	6
1954.....	1,599	— 52	469	—20
1955.....	1,713	114	477	8
1956.....	1,598	—115	473	— 4
1957.....	—	—	461	—12
1958.....	—	—	493	+32
1959.....	—	—	525	+32
1960.....	—	—	540	+15

* Dashes indicate data not available.

Sources:

Col. 1: This series consists of the number of licenses issued for each year. This information was obtained directly from the California Bureau of Milk Stabilization, Licensing Section, and was published in Stewart Johnson, **Dairy Marketing** (Storrs: Connecticut Agricultural Extension Service, 1956).

Col. 3: 1951-1957: California Crop and Livestock Reporting Service, **California Dairy Industry Statistics for 1951: Manufactured Dairy Products, Milk Production, Utilization, and Prices** (Sacramento, 1951, and subsequent annual issues).

1958-1960: From special compilations by the California Crop and Livestock Reporting Service.

Again, each plant is counted as a separate distributor. This series also appears in table B-1.

These data show the net changes in numbers of dealers and processing plants, by years. No further published data are available concerning the breakdown of this net change in number or identity of the firms leaving or entering the industry. In view of this lack of published data, unpublished sources of information were consulted.

Sources of unpublished data

For several decades each fluid milk distributor in the state of California has been required to file reports with the California Crop and Livestock Reporting Service concerning receipts and utilization of milk. The California Department of Agriculture in turn published annually the *Official List of Milk Products Plants and Fluid Milk Distributors*. Publication of this list was discontinued in 1947, and a coding system of identification was later devised. Code numbers were assigned to all distributors named in the final issue of the list and have been assigned to all distributors who have entered the industry since then. Receipt of each report is recorded on a card which is kept current for each distributor, indicating whether the distribution unit operated a plant, conducted retail home-delivery operations, etc. Upon termination of operations by a distributor, this card is placed in an "out of business" file. As new distributors enter the industry, new code numbers are assigned and the detail of their reports is entered on new cards. When ownership of a distribution unit is transferred between firms or individuals, a new card is prepared for the new firm, but the original code number is retained. The old card is then removed from the active file and placed in the out-of-business file, which thus reflects changes in ownership.

The Licensing Section of the California Bureau of Milk Stabilization also maintains a current file of licensed distributors completely separate from the records kept by the California Crop and Livestock Reporting Service. Here, too, when distributors terminate operations their cards are placed in an out-of-business file. Although the coding of the Licensing Section is different from that of the California Crop and Livestock Reporting Service, identity may usually be established by firm name and address. This file provides important supplementary details concerning the functions performed by the distributors (processing, production, etc.).

In addition to these data, still further information may be obtained from the California Bureau of Dairy Service, which maintains a current file of all fluid milk processing plants and has available an out-of-business file for a part of the 1950-1958 period.

Compilation of the target population

It was decided to combine the available information into a yearly series of firms, maintaining the identity of all firms entering and leaving the industry. The list of code numbers and the out-of-business files were the primary sources of information used in this compilation.

Between 1947, when the coding system was initiated, and December 31, 1958, 1,682 code numbers had been assigned. In addition, 73 entrants had begun operating under the code number of the previous owner. To obtain all possible information concerning the target population, an effort was made to determine the current status of each of these 1,755 plants. Among these plants were many that did not process fluid milk. Also, code numbers had been assigned to each operating unit of multi-plant firms.

The first step in determining the current status of these 1,755 plants was to ascertain which of them continued in operation after December 31, 1958. These accounted for 445 of the plants. The remaining 1,310 distribution units were then examined in an effort to determine which belonged in the target population. The out-of-business files provided a classification of functions performed and the date of termination of operations. Using this information, it was possible to eliminate from the target population distributors in the following categories:

1. Distributors that did not process fluid milk (peddlers).
2. Distributors that terminated operations prior to 1950.
3. Plants that were a part of multiplant firms. (These multiplant firms, just as single-plant firms, were counted only once.)⁶⁵

Fluid milk processing firms that terminated processing operations between January 1, 1950, and December 31, 1958, were classified as elements of the exant population, while those that commenced processing between these dates were classified as elements of the entrant population. In a few of these cases, there was no information as to whether the processing operation was performed. These were nevertheless counted in order to avoid the possibility of underestimating the target population.

Given the above information, it was possible to eliminate or classify all but 140 plants. Letters were sent to the appropriate local municipal and county health authorities and the regional offices of the California Bureau of Milk Stabilization asking for information regarding these plants. With the details obtained from these

⁶⁵ This procedure in developing the target population serves to explain the variance occurring between the series shown in table 18 and the published statistics regarding numbers of milk processing plants.

sources, 95 of the 140 units were classified. No further information could be obtained concerning the remaining 45 distributors.

The data used in estimating the target population also served as the basis of a series of firm numbers with entries and exits by years for 1950–1958. Given the estimated number of firms operating at the end of 1958 (445) and the net change for each previous year, the number of firms operating at the end of each year was developed.

Drawing the sample⁶⁶

From the population of 381 entrants and 493 exants, a sample was desired which would ensure a standard error of estimate of the mean of not more than 10 per cent. Size of sample influences the standard error of estimate. To simplify the discussion, assume that the size of the population, N , is 500 and that the population parameter to be estimated is the proportion of the population having some particular attribute. The standard error of estimate also depends on the variability that exists in the population. A proportion of 0.5 corresponds to the largest variability of the population when sampling attributes. When sampling from a very large population, the standard error of estimate is equal to $\sqrt{\frac{\sigma}{n}}$ where σ^2 is the population variance. For a population proportion, π , of 0.5, $\sigma = \sqrt{\pi \cdot (1 - \pi)} = \sqrt{.25} = 0.5$. Suppose that the objective is to estimate the population proportion $\pi = 0.5$, using a method that will ensure an average error of 10 per cent. This implies that $\sqrt{\frac{0.5}{n}} = 0.05$ and that n should be 100. In other words, using unrestricted random sampling from a large population having a proportion of 0.5 possessing some attribute, a sample of 100 elements is needed to ensure a standard error of estimate of 10 per cent. Actually, the accuracy is better than this, since the population is not large relative to the sample size. Under these conditions, the standard error is not $\sqrt{\frac{\sigma}{n}}$ but $\sqrt{\frac{\sigma}{n} \cdot \frac{N-n}{N-1}}$. In other words, the standard error in the instance cited would not be 0.05 but $(0.05) \frac{400}{499}$, or approximately .04.

In the particular case of the population of 493 exants, it may be observed that the sample size of 84 achieves the desired result of a coefficient of variation of less than 0.1:

$$\sqrt{\frac{0.5}{84} \cdot \frac{493 - 84}{492}} + 0.045 \text{ and } \frac{0.045}{0.5} < 0.1.$$

In the case of the population of 381 entrants, a sample of 80 achieves the desired result:

$$\sqrt{\frac{0.5}{80} \cdot \frac{381 - 80}{380}} = 0.044 \text{ and } \frac{0.044}{0.5} < 0.1.$$

The samples were drawn using random numbers. An additional 40 alternatives were drawn from among the exants, while 20 alternative entrants were drawn. This number of alternatives was more than adequate in both cases.

⁶⁶ The authors are indebted to Professor J. N. Boles for his assistance in drawing the sample for this phase of the analysis.